UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

June 30, 2010

Mr. Michiel Holley
Acting Chief
North Permits Branch
Regulatory Division
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Subject: Permit #SAJ-2002-02052(SP-BAL)
Ocean Disposal of Dredged Material from the Mayport Harbor Deepening Project

Dear Mr. Holley:

This letter is in regard to your May 27, 2010, request for concurrence on the suitability for ocean disposal of dredged material from new work dredging at Mayport Harbor pursuant to Section 103 of the Marine Protection Research and Sanctuaries Act (MPRSA). This dredging will require modification of permit # SAJ-2002-02052(SP-BAL). Your letter included a MPRSA Section 103 Evaluation for this project dated May, 2010. Additional information was received on June 16, 2010 and June 22, 2010. The evaluation supplements a previous evaluation submitted in August 2009. The U.S. Environmental Protection Agency (EPA) Region 4 provided a limited concurrence on October 5, 2009, as insufficient sampling was conducted to characterize the turning basin.

The project consists of deepening and widening the Mayport Turning Basin, the Mayport Entrance Channel and the Jacksonville Harbor Federal Navigation Channel seaward of station 196+00. Project depths vary throughout the project from -50 to -52 feet mean lower low water plus 2 feet of paid allowable overdepth dredging, depending on advance maintenance requirements. Total in situ project new work volumes are expected to range from 4.5 to 5.2 million cubic yards inclusive of paid allowable overdepth volumes plus up to 1.09 million cubic yards of shoaling material. It is proposed that up to 2 million cubic yards of the new work dredged material will be disposed at the Jacksonville Ocean Dredged Material Disposal Site (ODMDS) and the remainder to be disposed at the Fernandina Beach ODMDS. The shoaling material can be disposed at either ODMDS.

We have completed our review of your Section 103 Evaluation Report and supporting documents and have completed an independent evaluation of the dredged material and conditionally concur with your determination that the proposed dumping at the Jacksonville and Fernandina Beach ODMDSs will comply with the criteria set forth in 40 CFR Part 227. A brief discussion of the compliance of the material with the criteria is provided below:

1. **Water Column and Suspended Phase Determinations - 40 CFR § 227.6(c)(1&2) and 227.27(a&b)**
   None of the elutriate analytes exceeded the Federal Water Quality Criteria (WQC) prior to any dilution. Therefore, no mixing is required in order to meet the WQC and it is not expected that the WQC will be exceeded at any time outside of the disposal site or four hours after disposal within the Jacksonville and Fernandina Beach ODMDSs.

   Bioassays on three appropriate sensitive marine organisms were conducted. There was a statistically significant difference between the control seawater and the elutriate samples for one or more of the three organisms in one or more of the dredging units sampled. Water column effects at the two ODMDSs were modeled for the various dredging units and potential dredging technologies. The modeling has shown that there is sufficient dilution to meet the Limiting Permissible Concentration (LPC) for all dredging units and all dredging technologies at the Fernandina Beach ODMDS. However, for the Jacksonville ODMDS, modeling has shown that special management controls regarding disposal location and disposal vessel size restrictions must be utilized in order to meet the LPC. These controls are outlined in the enclosed list of conditions. Accordingly, it is concluded that the liquid and suspended phases of the material are in compliance with 40 CFR 227.6(c)(1&2) and 227.27(a&b) only if the enclosed management controls are implemented.

2. **Benthic Determinations - 40 CFR § 227.6(c)(3) and 227.27(b)**
   Solid phase toxicity evaluation: 10-day toxicity tests were conducted on the project sediments using shrimp (*Mysidopsis bahia*) and amphipods (*Leptocheirus plumulosus*), which are appropriate sensitive benthic marine organisms. These organisms are good predictors of adverse effects to benthic marine communities. For the shrimp, the toxicity of the sediments ranged from 12 to 25 percent. Although some of the stations exceeded the reference mortality by more than 10 percent none were statistically significantly different. For the amphipods, the toxicity of the project sediments ranged from 9 to 17 percent and did not exceed the reference sediment by more than 20 percent. These results show that the solid phase of the material is not likely cause significant mortality and meets the solid phase toxicity criteria of §227.6(c)(3) and 227.27(b).

   Solid phase bioaccumulation evaluation: 28-day bioaccumulation tests were conducted using two appropriate sensitive benthic marine organisms, *Nereis virens* and *Macoma nasuta.* Tissue concentrations were compared to Food and Drug Administration (FDA) Action Levels. None of the contaminants, for which there are FDA Action Levels, exceed such thresholds in the tissues of organisms exposed to project sediments. Concentrations of contaminants in tissues of organisms exposed to project sediments were then compared to concentrations in tissues of organisms exposed to a reference sediment. Sixteen analyzed were found to be statistically higher in the organisms exposed to dredged material than the reference material. When the bioaccumulation of contaminants in tissues exposed to dredged material exceeds that exposed to reference sediments, general risk-based evaluations must be conducted to evaluate compliance with 227.13(c)(3). EPA conducted such an evaluation and

determined that there is no potential for undesirable effects due to bioaccumulation as a result of the presence of individual chemicals or of the solid phase of the dredged material as a whole. Accordingly, it is concluded that the solid phase of the material proposed for disposal meets the ocean disposal criteria at 40 CFR §227.6(c)(3) and 227.27(b).

Pursuant to MPRSA Section 104(a)(4), ocean disposal permits must be conditioned to assure consistency with approved Site Management and Monitoring Plans (SMMP). The Jacksonville ODMDS SMMP was reviewed and revised in November 2007 and further revised in June 2010. The Fernandina Beach ODMDS SMMP was reviewed and revised in February 2010. This letter of concurrence is conditional upon implementation through permit conditions of the requirements of both SMMPs and the enclosed list of management control conditions for compliance with the LPC. In addition to those conditions, this letter of concurrence is conditional upon permit conditions limiting project limits (width and depth) consistent with the Final Environmental Impact Statement for the Proposed Homeporting of Additional Surface Ships at Naval Station Mayport, Florida, and a mid-project bathymetry survey at the Jacksonville ODMDS to insure that excessive mounding is not occurring.

If you have any questions regarding this determination or management of the Jacksonville and Fernandina Beach ODMDSs, please contact Mr. Chris McArthur at (404) 562-9391.

Sincerely,

James D. Giattina
Director
Water Protection Division

Enclosure

Ocean Disposal Management Controls and Conditions
Necessary for Compliance with the Limiting Permissible Concentration
Permit #SAJ-2002-02052(SP-BAL)
Ocean Disposal of Dredged Material from the Mayport Harbor Deepening Project

1. Jacksonville ODMDS Management Controls and Conditions

Project Area*	Dredge Type	Volume Restrictions (cubic yards)	Placement Restrictions
Western MTB (west of Station 9+65)	Clamshell	<6,000	Northwest A / Southeast A (1,500 x 4,000 ft)
	Cutterhead	<5,000	Northwest B / Southeast B (500 x 3,000 ft)
	Hopper	<5,500	Northwest B / Southeast B (500 x 3,000 ft)
Eastern MTB (Station 0+00 – 9+65)	Clamshell	<6,000	Northwest A / Southeast A (1,500 x 4,000 ft)
	Cutterhead	<6,000	
	Hopper	<9,500	
MEC & BC3	Clamshell	<6,000	Northwest A / Southeast A (1,500 x 4,000 ft)
	Cutterhead	<6,000	
	Hopper	<13,000	

*MTB: Mayport Turning Basin; MEC: Mayport Entrance Channel; BC3: Bar Cut 3

2. Jacksonville ODMDS Release Zones

The following Release Zones shall be utilized. The Northwest Release Zones shall be utilized during southerly currents and the Southeast Release Zones shall be utilized during northerly currents. Current direction will be based on tides predicted from current measurements collected by EPA at the Jacksonville ODMDS. A table of predicted currents will be provided to the applicant by the Jacksonville District Corps of Engineers prior to the initiation of dredging and subject to EPA approval.

1,500 x 4,000
Northwest A Release Zone

	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 21 25.92997	-81 18 27.56902	2,189,967	559,132
NE	30 21 25.89005	-81 18 27.70587	2,189,963	563,120
SW	30 21 11.04240	-81 18 27.62516	2,188,463	559,123
SE	30 21 11.06847	-81 17 41.95932	2,188,455	563,124

1,500 x 4,000
Southeast A Release Zone

	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 20 50.69682	-81 18 16.66213	2,186,405	560,078
NE	30 20 50.60776	-81 18 16.65044	2,186,396	564,079
SW	30 20 35.84888	-81 18 16.69603	2,184,905	560,071
SE	30 20 35.86403	-81 17 31.00045	2,184,896	564,075

500 x 3,000
Northwest B Release Zone

	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 21 25.92997	-81 18 27.56902	2,189,967	559,132
NE	30 21 26.00913	-81 17 53.40684	2,189,967	562,125
SW	30 21 20.98073	-81 18 27.55354	2,189,467	559,132
SE	30 21 21.05988	-81 17 53.39183	2,189,467	562,125

500 x 3,000 Southeast B Release Zone				
	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 20 40.77499	-81 18 05.34429	2,185,400	561,067
NE	30 20 40.75388	-81 17 31.02637	2,185,390	564,074
SW	30 20 35.85543	-81 18 05.32921	2,184,903	561,067
SE	30 20 35.86403	-81 17 31.00045	2,184,896	564,075

3. Fernandina Beach ODMDS Management Controls and Conditions

Project Area*	Dredge Type	Volume Restrictions (cubic yards)	Placement Restrictions
MTB	Clamshell	<6,000	Release Zone as specified in the Fernandina Beach ODMDS Site Management and Monitoring Plan
	Cutterhead	<6,000	
	Hopper	<11,500	
MEC & BC3	Clamshell	<6,000	Release Zone as specified in the Fernandina Beach ODMDS Site Management and Monitoring Plan
	Cutterhead	<6,000	
	Hopper	<13,500	

*MTB: Mayport Turning Basin; MEC: Mayport Entrance Channel; BC3: Bar Cut 3

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MEMORANDUM

TO: Jon Doi, Aqua Survey

FROM: Paul Berman, ANAMAR Environmental Consulting, Inc

DATE: June 16, 2010

REF: Summary Results for Mayport STFATE Model

Please find attached the summary report for the Mayport STFATE model for disposal into the Jacksonville ODMDS. All input and output files for the model are included electronically on the attached CD.

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ADDAMS Model

Simulations of the STFATE module of the ADDAMS model were run to establish the compliance of the water column toxicity for the Mayport Harbor sediment samples. Based on analytical results, no samples were selected for modeling Tier II – Water Quality Criteria as all results were below the CMC (National Recommended Water Quality Criteria: 2008, Criteria Maximum Concentration).

Based on the LC_{50} results, twenty applications (runs) of the model are presented in this report for Section 103 Regulatory Analysis for Ocean Water, Tier III, Short-Term Fate of Dredged Material from Split Hull Barge or Hopper/Toxicity Run.

Initial physical and suspended particulate phase results for the Mayport Harbor sediment samples are shown in the table below.

Sample: / Analyte	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	E-MP09-5 (Field Dup. of 4)
Solids %	31.2	37.0	28.9	29.0	31.6
Gravel	0.0	0.3	0.0	0.0	0.0
Sand	7.1	34.9	3.9	13.3	9.9
Silt	49.5	30.4	43.8	42.2	46.1
Clay	43.4	34.4	52.3	44.5	44.0
EC_{50} Larval – dev. (*M. edulis*)	20.6	22.4	22.4	21.9	22.4
LC_{50} *M. beryllina*	24.0	46.7	40.7	33.1	31.6
LC_{50} *A. bahia*	70.7	70.7	65.2	68.3	70.7

Based upon these initial results, five applications of the STFATE model were performed using the data from the *Mytilus edulis* test. This analysis limited the disposal to the northwest corner of the ODMDS, at a maximum of 1500 cy. After these results were reported, it was determined that ammonia had likely increased mortality in the *Mytilus edulis* and *Menidia beryllina*. These tests were redone using ammonia amelioration and the results indicated that ammonia was responsible for the mortality and EPA authorized a change in the application factor from 0.01 to 0.05 in the STFATE model. Since the *Americamysis bahia* test was not redone, the application factor for this species remained at 0.01, and the LC_{50} for this test was used in the model.

The sediment characteristics presented above for all stations were used to calculate the volumetric fractions. Input parameters were taken from the Southeast Regional Implementation Manual. Additional parameters related to the barge and disposal operations were provided by USACE Jacksonville. The tables on the following pages show the input parameters used.

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Simulation Type: Descent, Collapse, and Diffusion

Coefficients		
Parameter	**Keyword**	**Value**
Settling Coefficient	BETA	0.000[1]
Apparent Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model Default Value

Site Description

Parameter	Value	Units
Number of Grid Points (left to right)	45	n/a
Number of Grid Points (top to bottom)	45	n/a
Spacing Between Grid Points (left to right)	350	ft
Spacing Between Grid Points (top to bottom)	350	ft
Constant Water Depth	46	ft
Roughness Height at Bottom of Disposal Site	0.005[1]	ft
Slope of Bottom in X-Direction	0	deg.
Slope of Bottom in Z-Direction	0	deg.
Number of Points in Ambient Density Profile Point	2	n/a
Ambient Density at Depth = 0 ft	1.0221	g/cc
Ambient Density at Depth = 46 ft	1.0236	g/cc
Distance from the Top Edge of Grid (upper left corner of site)	2,660	ft
Distance from the Left Edge of Grid (upper left corner of site)	4,660	ft
Distance from the Top Edge of Grid (lower right corner of site)	8,740	ft

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Parameter	Value	Units
Distance from the Left Edge of Grid (lower right corner of site)	10,740	ft
Number of Depths for Transport-Diffusion Output	2 (0 and 46)	#

[1]Model Default Value

Current Velocity Data

Parameter	Value	Units
X-Direction Velocity @ 8.2 ft	0.52	ft/sec
Z-Direction Velocity @ 8.2 ft	0.21	ft/sec
X-Direction Velocity @ 40.0 ft	0.31	ft/sec
Z-Direction Velocity @ 40.0 ft	0.12	ft/sec

Velocity data from current measurements, August 2006 – September 2008

Material Data

Parameter	Value	Units
Dredging Site Water Density (average)	1.0246	g/cc
Number of Layers	1	n/a
Material Volume	4000/6000	Yd^3
Material Velocity at Disposal (X-Dir)	7.3	ft/s
Material Velocity at Disposal (Z-Dir)	0.0	ft/s

Output Options

Parameter	Value	Units
Duration of Simulation	14,400	sec
Long-Term Time Step	600	sec

Disposal Operation Data

Parameter	Value	Units
Vessel Type	Barge/Scow	n/a
Length of Disposal Vessel	312	ft
Width of Disposal Vessel	54	ft
Pre-Disposal Draft	22	ft
Post-Disposal Draft	10	ft
Time Needed to Empty the Disposal Bin (sec)	300	sec

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Results of the initial mixing simulations after 4 hours of mixing (specified for water column evaluation) and the maximum concentration found outside the disposal area for each dredging unit are summarized in accordance with Section 7.4 of the SERIM and shown below. For each simulation, the depth at maximum concentration (36 ft) is included. In addition, the location of the maximum concentration is shown as X Location and Z Location.

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The results of the STFATE model show that disposal may not occur at the center of the disposal area without failing the boundary criteria during the simulation. In order to meet criteria, the area of disposal must be restricted in size. The coordinates of the northwest and southeast corners are shown in the table below.

Dredge Material Volume	Northwest Corner		Southeast Corner	
	From Top Edge	From Left Edge	From Top Edge	From Left Edge
4000 cubic yards	3000	5000	4000	9000
6000 cubic yards	3000	5000	3500	9000

Four Hour Criteria after Initial Mixing at 4000 cy

Depth, feet	% Max Conc Above Background on Grid	Dilution on Grid ($D_{a\text{-}tox}$)	X Location	Z Location	% Max Conc Above Background on Grid	Dilution on Grid ($D_{a\text{-}tox}$)	X Location	Z Location
Sample	E-MP09-1, 4000 cy, NW corner				E-MP09-1, 4000 cy, SE corner			
0	3.86E-11	>1,000,000	9100	6650	3.93E-11	>1,000,000	10150	10500
36 (Max)	0.196	509	9100	6650	0.200	499	10150	10500
46	0.0266	3758	9100	6650	0.0271	3689	10150	10500
Sample	E-MP09-2, 4000 cy, NW corner				E-MP09-2, 4000 cy, SE corner			
0	3.47E-11	>1,000,000	9100	6650	3.53E-11	>1,000,000	10150	10500
36 (Max)	0.179	558	9100	6650	0.0604	1655	10150	10500
46	0.0242	4131	9100	6650	0.0242	4131	10150	10500
Sample	E-MP09-3, 4000 cy, NW corner				E-MP09-3, 4000 cy, SE corner			
0	3.94E-11	>1,000,000	9100	6650	4.01E-11	>1,000,000	10150	10500
36 (Max)	0.203	492	9100	6650	0.207	482	10150	10500
46	0.0275	3635	9100	6650	0.028	3570	10150	10500
Sample	E-MP09-4, 4000 cy, NW corner				E-MP09-4, 4000 cy, SE corner			
0	3.95E-11	>1,000,000	9100	6650	4.02E-11	>1,000,000	10150	10500
36 (Max)	0.203	492	9100	6650	0.207	482	10150	10500
46	0.0275	3635	9100	6650	0.028	3570	10150	10500
Sample	E-MP09-4 FD, 4000 cy, NW corner				E-MP09-4 FD, 4000 cy, SE corner			
0	3.84E-11	>1,000,000	9100	6650	3.91E-11	>1,000,000	10150	10500
36 (Max)	0.195	512	9100	6650	0.199	502	10150	10500
46	0.0264	3787	9100	6650	0.0269	3716	10150	10500

Dilution ($D_{a\text{-}tox}$) = (100 – max conc.)/max conc.

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Disposal Site Boundary Criteria after Initial Mixing at 4000 cy

Depth, feet	Time, hours	Max Conc Outside Disposal Area	Dilution ($D_{a\text{-}tox}$)	Time, hours	Max Conc Outside Disposal Area	Dilution ($D_{a\text{-}tox}$)
Sample	E-MP09-1, 4000 cy, NW corner			E-MP09-1, 4000 cy, SE corner		
0	4	3.86E-11	>1,000,000	4	3.93E-11	>1,000,000
36 (Max)	3.33	0.294	339	2.5	0.595	167
46	3.33	0.0398	2512	2.5	0.0804	1243
Sample	E-MP09-2, 4000 cy, NW corner			E-MP09-2, 4000 cy, SE corner		
0	4	3.47E-11	>1,000,000	4	3.53E-11	>1,000,000
36 (Max)	3.33	0.267	374	2.5	0.54	184
46	3.33	0.0362	2761	2.5	0.073	1369
Sample	E-MP09-3, 4000 cy, NW corner			E-MP09-3, 4000 cy, SE corner		
0	4	3.94E-11	>1,000,000	4	4.01E-11	>1,000,000
36 (Max)	3.33	0.305	327	2.5	0.616	161
46	3.33	0.0412	2426	2.5	0.0834	1198
Sample	E-MP09-4, 4000 cy, NW corner			E-MP09-4, 4000 cy, SE corner		
0	4	3.95E-11	>1,000,000	4	4.02E-11	>1,000,000
36 (Max)	3.33	0.305	327	2.5	0.616	161
46	3.33	0.0412	2426	2.5	0.0833	1199
Sample	E-MP09-4 FD, 4000 cy, NW corner			E-MP09-4 FD, 4000 cy, SE corner		
0	4	3.84E-11	>1,000,000	4	3.91E-11	>1,000,000
36 (Max)	3.33	0.292	341	2.5	0.59	168
46	3.33	0.0395	2531	2.5	0.0799	1251

Dilution ($D_{a\text{-}tox}$) = (100 – max conc.)/max conc.

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Four Hour Criteria after Initial Mixing at 6000 cy

Depth, feet	% Max Conc Above Background on Grid	Dilution on Grid ($D_{a\text{-}tox}$)	X Location	Z Location	% Max Conc Above Background on Grid	Dilution on Grid ($D_{a\text{-}tox}$)	X Location	Z Location
Sample	E-MP09-1, 6000 cy, NW corner				E-MP09-1, 6000 cy, SE corner			
0	6.19E-11	>1,000,000	9100	6650	6.22E-11	>1,000,000	9800	10500
36 (Max)	0.274	364	9100	6650	0.275	363	9800	10500
46	0.0371	2694	9100	6650	0.0373	2680	9800	10500
Sample	E-MP09-2, 6000 cy, NW corner				E-MP09-2, 6000 cy, SE corner			
0	5.88E-11	>1,000,000	9100	6650	5.90E-11	>1,000,000	9800	10500
36 (Max)	0.249	401	9100	6650	0.251	397	9800	10500
46	0.0377	2652	9100	6650	0.0339	2949	9800	10500
Sample	E-MP09-3, 6000 cy, NW corner				E-MP09-3, 6000 cy, SE corner			
0	6.56E-11	>1,000,000	9100	6650	6.72E-11	>1,000,000	9800	10500
36 (Max)	0.283	352	9100	6650	0.29	344	9800	10500
46	0.0384	2603	9100	6650	0.0393	2544	9800	10500
Sample	E-MP09-4, 6000 cy, NW corner				E-MP09-4, 6000 cy, SE corner			
0	6.54E-11	>1,000,000	9100	6650	6.70E-11	>1,000,000	9100	6650
36 (Max)	0.283	352	9100	6650	0.29	344	9750	7750
46	0.0383	2610	9100	6650	0.0393	2544	9100	7750
Sample	E-MP09-4 FD, 6000 cy, NW corner				E-MP09-4 FD, 6000 cy, SE corner			
0	6.11E-11	>1,000,000	9100	6650	6.14E-11	>1,000,000	9100	6650
36 (Max)	0.272	367	9100	6650	0.273	365	9750	7750
46	0.0368	2716	9100	6650	0.037	2702	9100	7750

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Disposal Site Boundary Criteria after Initial Mixing at 6000 cy

Depth, feet	Time, hours	Max Conc Outside Disposal Area	Dilution ($D_{a\text{-}tox}$)	Time, hours	Max Conc Outside Disposal Area	Dilution ($D_{a\text{-}tox}$)
Sample	E-MP09-1, 6000 cy, NW corner			E-MP09-1, 6000 cy, SE corner		
0	4	6.19E-11	>1,000,000	4	6.22E-11	>1,000,000
36 (Max)	3.33	0.417	239	2.83	0.670	148
46	3.33	0.0564	1772	2.83	0.0906	1103
Sample	E-MP09-2, 6000 cy, NW corner			E-MP09-2, 6000 cy, SE corner		
0	4	5.88E-11	>1,000,000	4	5.90E-11	>1,000,000
36 (Max)	3.33	0.38	262	2.83	0.609	163
46	3.33	0.0514	1945	2.83	0.0824	1213
Sample	E-MP09-3, 6000 cy, NW corner			E-MP09-3, 6000 cy, SE corner		
0	4	6.56E-11	>1,000,000	4	6.72E-11	>1,000,000
36 (Max)	3.33	0.433	230	3	0.616	161
46	3.33	0.0586	1705	3	0.0833	1199
Sample	E-MP09-4, 6000 cy, NW corner			E-MP09-4, 6000 cy, SE corner		
0	4	6.84E-11	>1,000,000	4	6.70E-11	>1,000,000
36 (Max)	3.33	0.432	230	3	0.615	162
46	3.33	0.0585	1708	3	0.0832	1201
Sample	E-MP09-4 FD, 6000 cy, NW corner			E-MP09-4 FD, 6000 cy, SE corner		
0	4	6.11E-11	>1,000,000	4	6.14E-11	>1,000,000
36 (Max)	3.33	0.414	241	2.83	0.665	149

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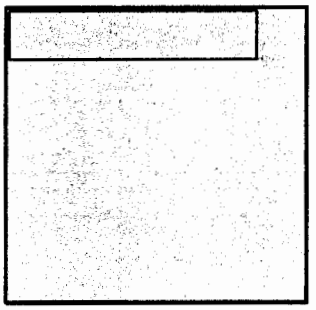
Disposal Map for Mayport Harbor Dredge Material in the Jacksonville ODMDS

Model Grid = 45 grids x 45 grids @ 350 feet/grid
Total size = 15750 feet x 15750 feet



ODMDS Size in blue = 6080 feet x 6080 feet

Disposal area shown in yellow in the map is 1000 feet x 5000 feet for 4000 cy disposal and 500 feet x 5000 feet for 6000 cy disposal. Northwest corner of disposal area is at 3000 feet x 5000 feet for both volumes.

Surface current velocity = 0.56 ft/s
V_x = 0.52 ft/s
V_z = 0.21 ft/s

Bottom current velocity = 0.33 ft/s
V_x = 0.31 ft/s
V_z = 0.12 ft/s

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MPRSA 103 Evaluation
Naval Station Mayport Construction Dredging – Turning Basin
22 June 2010

1.0 Project Overview

This independent 2010 Marine Protection Resource and Sanctuaries Act (MPRSA) 103 Evaluation (2010 Evaluation) evaluates the potential dredged material (DM) from construction depths within the Turning Basin of Naval Station (NS) Mayport. The DM is proposed for disposal in the Jacksonville and the Fernandina Beach Ocean Dredged Material Disposal Sites (ODMDS).

The US Environmental Protection Agency (USEPA) filed an MPRSA 103 Evaluation Decision Memo for NS Mayport on September 25, 2009. The limitations of the 103 Concurrence were outlined as 3,000 cubic yard (cy) load size from all project reaches, Mayport Turning Basin, Mayport Entrance Channel, and Jacksonville Harbor Federal Navigation Channel Bar Cut 3 (Bar Cut 3), for Jacksonville ODMDS. The Mayport Turning Basin test components were not included in the 2009 Evaluation, and as a result, Zones 1 and 2 were excluded from the previous review for the following reason.

The sampler was unable to gather enough silt sediments from the Mayport Turning Basin and decided to combine samples from two zones. By combining zones, the sampling did not meet the requirements of the Southeast Regional Implementation Manual (SERIM) for the representative number of samples for the amount of dredged material. Based on consultation with the USEPA, US Army Corps of Engineers (USACE) decided to retest the silt sediments in NS Mayport Turning Basin and to model for optimum load size in all reaches of the project for placement in both the Jacksonville and Fernandina Beach ODMDS.

Vibracore samples of the silt sediments from four zones within the Turning Basin were conducted in January 2010. Elutriate bioassay test results reported that three of the zones had elutriate LC_{50} results between 24.0 and 33.1 percent; an amount that would limit the quantities for disposal in the Jacksonville ODMDS. Sediment and elutriate samples had elevated levels of ammonia. Following consultation with the USEPA and USACE Environmental Research Development Center (ERDC), the USACE decided to conduct additional testing to determine whether the cause for the toxicity was due to ammonia.

Since ammonia is naturally stripped from the sediments and chemically changes into other compounds in the presence of oxygen, its impact is minimized with dilution and aeration. Additional sampling was performed with the purpose of executing an ammonia purge protocol for testing along with a normal elutriate test method. Additional chemical analysis was performed to determine whether dissolved metals remained in solution during the ammonia purge thereby isolating the toxicity cause to ammonia loss and not metal(s) loss. Results for *Menidia beryllina* (*M. beryllina*) and *Mytilus edulis* (*M. edulis*) exhibited equal survival to the control when stripped of ammonia. *Americamysis bahia* (*A. bahia*) displayed improved survival in the ammonia purged elutriate samples but did not clearly indicate ammonia to be the sole contributor of toxicity. Additional testing of *A. bahia* was not pursued because the original LC_{50} (65.2 percent for E-MP09-03) provided adequate disposal quantities when entered into the Short Term Fate (STFATE) module of the ADDAMS model.

ERDC prepared a Draft Literature Review to support our understanding of ammonia in marine systems. Additional information will be added to this document with our continued study of ammonia. The draft document dated 24 May 2010 and revised 10 June 2010, discussed

ammonia and metals (arsenic, silver, and copper) toxicity in the three sensitive species used in the liquid phase bioassay testing. Refer to Section 3 of the 2010 Evaluation for additional information and the enclosed Draft Literature Review.

Upon evaluation of the preliminary 2010 data, the USEPA decided that the tests did not clearly eliminate the cause of the elutriate bioassay toxicity from the 2009 testing in zone 1 (E-MP08-1). Additional STFATE modeling was required to determine the quantity of material acceptable for disposal in the Jacksonville and Fernandina Beach ODMDS. Modeling also encompasses mechanical and hydraulic dredge equipment types and material from each of the three3 project areas: Mayport Turning Basin, Mayport Entrance Channel, and Jacksonville Harbor Bar Cut 3 (Bar Cut 3).

Modeling results indicate that all Mayport Turning Basin DM is acceptable for disposal at the Jacksonville and Fernandina Beach ODMDS up to 6,000 cubic yards (cy) per load for mechanical dredge types, up to 9,500 cy per load for hopper dredges, and 5,000 cy per load for cuttersuction dredges using a barge. The release zones have been specified in the specific conditions for the northwest and southeast corners of the Jacksonville ODMDS and within 1,500 ft of the Fernandina Beach ODMDS boundaries. Load size is restricted west of Mayport Turning Basin Station 9+65 for hopper and cuttersuction dredge types for placement in either the Jacksonville or Fernandina Beach ODMDS. Please refer to Section 3 of the 2010 Evaluation for more information and the DRAFT USACE ADDAMS Model Report (Tab 3 Appendix D) for specific modeling outcomes.

1.1 Project Description

NS Mayport is located on the east coast of Florida at the mouth of the St. Johns River. The basin is located south of the river with an entrance channel that enters the river immediately west of the South Jetty.

The United States Navy (Navy) has Congressional authority to deepen Bar Cut 3, the Mayport Entrance Channel, and Mayport Turning Basin to allow continued operation of mission critical ship movements in and out of NS Mayport. Currently, an effort is underway to obtain all necessary permits and approvals to construct the project. The project will commence after the award date, 31 August 2010 and the estimated date of completion is 21 March 2012.

Approximately 5,150,000 cy of in situ material (all DM quantities are "approximate" and "in situ" unless specified otherwise) will be dredged from these three project areas. 2,860,000 cy of material will be dredged from the Federal Navigation Channel (Bar Cut 3) from a portion that is 21,000 feet in length by 600 feet in width and 17,200 feet in length by 800 feet in width. 1,150,000 cy of material will be dredged from 5,000-feet in length by 500-feet in width portion of the Mayport Entrance Channel, and 1,140,000 cy of DM will be dredged from a 91 acre portion of the Mayport Turning Basin.

The basin and channels will be dredged to a maximum depth of 50-feet Mean Lower Low Water (MLLW), plus 2-feet allowable over depth, except in high shoaling areas. The high shoaling areas will be dredged to a depth of 50-feet MLLW, plus 2-feet advance maintenance, plus 2-feet allowable over depth. The high shoaling areas are located in the Mayport Entrance Channel and Bar Cut 3 at Station 90+00 to 138+00 and Station 185+00 to 196+00. Dredge depths will not be authorized to exceed 59-feet MLLW. 1,090,000 cy of existing shoal material will be dredged from the Mayport Entrance Channel, Mayport Turning Basin, and Bar Cut 3 and will be

deposited in either Jacksonville or Fernandina Beach ODMDS. A project map with design features is enclosed in Tab 4. The destroyer slip and emergency boat basin are not included in this evaluation.

Up to 2,000,000 cy of DM from the Mayport Turning Basin, Mayport Entrance Channel, and Bar Cut 3 is proposed to be transported seaward and disposed in the Jacksonville ODMDS located in the Atlantic Ocean approximately 5.5 nautical miles southeast of the Turning Basin. The 1,090,000 cy of additional shoaling material will not be included in the 2,000,000 cy limit for the construction DM for disposal at the Jacksonville ODMDS.[1] The remaining quantity of construction DM is proposed to be transported seaward and disposed in the Fernandina Beach ODMDS located in the Atlantic Ocean approximately 8.5 nautical miles northeast of the Mayport Turning Basin.

Please refer to Section 6.0 MPRSA 103 Conditions for the proposed disposal release zones by project reach and station.

Material may be transported to either the Jacksonville or Fernandina Beach ODMDS depending on cost, operational, and environmental restrictions. The proposed dredging method would not be limited to and may include: clam shell, hydraulic, and hopper. The turning basin is typically dredged by clamshell due to maneuverability within the basin; however, USACE does not restrict dredge types that can bid for this project.

1.2 Historical Testing

The project is periodically maintenance dredged to 42 feet plus 2 feet allowable over depth in the Bar Cut 3, Mayport Entrance Channel and Mayport Turning Basin. Prior to 1994, material from maintenance cycles was placed in two upland sites located on NS Mayport; however, these sites are nearing capacity and are reserved for sediments that are not suitable for ocean disposal.

Mayport NS has been dredged approximately every two years with the last disposal event, a regular maintenance dredging event, in January 2010. Please refer to Section 2.2.1 of this report for historical dredge events and quantities. Historically, DM has been transmitted to the Jacksonville ODMDS and upland disposal sites only.

Complete sampling, analysis, and evaluation were completed in 2009, and a MPRSA 103 Concurrence was provided for the Mayport Entrance Channel and Bar Cut 3. Due to the following, a retest was required for MPRSA 103 Concurrence for the Mayport Turning Basin: restricted disposal quantities of DM from E-MP08-1 based on the outputs of the ADDAMS model and the reduced number of samples.

A Tier II evaluation of the Mayport Turning Basin was undertaken in the 2008 based on data from the 2007 Report. USACE and USEPA concluded that there was no reason to believe the sediments had become contaminated since complete sampling, analysis, and evaluation in 2002. USEPA granted a concurrence that expires in 19 December 2010.

1.3 Most recent Testing

[1] The quantity of shoaling material is based on the maximum cohesive sedimentation rate of 76 cm/yr found in the Hydrodynamic Report in Appendix A.5 page 18 of the Final EIS for the Proposed Homeporting of Additional Surface Ships at Naval Station Mayport, FL prepared by NAVFAC.

The data for this evaluation is contained in the "Final Mayport Naval Station Section 103 Sediment Characterization" prepared by Aqua Survey, Inc. hereafter referred to as the "2010 Report" and included with the USACE Mayport Turning Basin 103 Evaluation dated May 2010 hereafter referred to as the "2010 Evaluation." This testing and analysis was done in accordance with the USEPA/USACE joint publication, Evaluation of Dredged Material Proposed for Ocean Disposal - (Testing Manual), dated February 1991, referred to as the 1991 "Green Book" and the SERIM dated August 2008.

2.0 Exclusionary Criteria and Need for Testing (Tier I)

2.1 Exclusionary Criteria

Dredged materials from the Turning Basin of NS Mayport do not meet the exclusionary criteria set forth in §227.13(b)(1), (2), or (3) of the U.S. Environmental Protection Agency Regulation.

2.1.2 Grain Sizes of the Dredged Material

Vibracore samples from four zones in the turning basin were collected to project depth; however, only the silt layer was collected for analysis. The silt layer contains a mixture of fine sand (3.7% to 34.3%), silt (30.4% to 49.5%), and clay (34.4% to 52.3%).

E-MP09-1 Black silt and grey/brown fine sand.
E-MP09-2 Black silt and grey/brown fine sand.
E-MP09-3 Black silt and grey/brown fine sand.
E-MP09-4 Black silt with some shell fragments.

Vibracore samples in the Turning Basin, Zones 1 and 2, were collected to project depth. The cores contained medium grain sand (34.9% and 36.7% respectively), fine grain sand (36.7% and 51.5%), and silt and clay together (25.7% and 16.4%).

E-MP08-1 Dark gray silty fine sand with traces of sand size shell fragments.
E-MP08-2 Dark gray silty fine sand.

Particle Size Distribution, Percent Moisture, Total Suspended Solids, and Settling Rates are contained in Tables 11-17 of the 2010 Report.

2.1.3 Locations, Quantities and Types of Pollutants Discharged Upstream and Within the Dredging Area

Potential Contamination Source – NS Mayport is a major Navy homeport and the port area is heavily developed. Aircraft carriers and supporting battle group ships are the major users of the facility. Other warships also occasionally visit Mayport. Commercial ships are not supported by NS Mayport facilities. Facilities within the port area include an airfield, vehicle and marine repair facilities, and warehousing. Storage of hazardous and toxic materials is primarily confined to petroleum products including #6 and #2 fuel oil, diesel fuel, gasoline, and lubricants. All of the major storage facilities have confinement areas sufficient to contain any spills. The only permitted discharge into the basin, other than storm water, is a sewage outfall located east of Foxtrot Pier.

2.2 Need for Testing

After consideration of all available information including previous testing, dredging history and records of spills and discharges into the waters adjacent to NS Mayport, it has been determined that existing information does provide a sufficient basis for making a decision about whether the dredged material complies with §227.13 of the USEPA regulation. However, as this project involves new work to depths greater than previous projects, USACE decided to perform

additional elutriate chemical and bioassay testing in areas previously found acceptable for ocean disposal to confirm that the new work material is acceptable.

2.2.1 Dates of Previous Dredging and Quantities

Jacksonville ODMDS Disposal History

	Contract	Dredged Material Origination	Paid Volume	Total Contract Disposal Volume
2010	10-C-0009	NS Mayport	174,941 cy	272,288 cy
2008	08-C-0004	NS Mayport	582,846 cy	626,845 cy
2007	07-C-0015	Jacksonville Harbor	509,401 cy	510,630 cy
2006	05-C-0037	NS Mayport	857,501 cy	888,134 cy[1]
2005			59,667 cy	59,667 cy[1]
2003	02-C-0002	NS Mayport	933,000 cy	1,465,774 cy[1]
2001	C-0001 (FY01)	NS Mayport	Unknown	174,832 cy
2000	C-0070 (FY99)	NS Mayport	887,284 cy[1]	1,097,800 cy

Fernandina Beach ODMDS Disposal History - Kings Bay Entrance Channel and Fernandina Harbor

	Contract	Paid Volume	Total Contract Disposal Volume
2009	09-C-0052	1,052,387 cy	1,061,601 cy
2009	09-C-0011	235,585 cy	338,763 cy
2008	08-C-0002	752,479 cy	Data Not Available
2007	07-C-0019	578,311 cy[1]	578,311 cy[1]
2006	06-C-0005	368,209 cy[1]	368,209 cy[1]
2005		447,273 cy[1]	447,273 cy[1]
2004		850,792 cy[1]	850,792 cy[1]
2003	03-C-0002	750,530 cy	Data Not Available
2002	02-C-0005	761,486 cy	Data Not Available
2001	01-C-0001	771,887 cy[1]	Data Not Available
2000		298,845 cy[2] and 831,590cy[1]	1,130,435 cy[1]

All Jacksonville ODMDS activities listed here from historical events were from maintenance dredging activities.
Data was compiled by Navigation Branch, Operations Division (May 2010). Quantities were obtained by cross-referencing the information in Dredging Information System, archived contract plans and specifications, and final invoices (Form ENG 93).
[1]Obtained from previous data collection for the SMMP.
[2]Fernandina Harbor

2.2.2 Results and Dates of Previous Testing (2009, 2007, 2002, 1994)

2009 Evaluation

The Final Report for Naval Station Mayport 103 Evaluation 2008 dated March 2009 (2009 Report). This report represents field data and test results from sediment collection activities that occurred in July 2008. Five (5) Samples were taken from each of the seven (7) zones throughout the Mayport Turning Basin, Entrance Channel, and Bar Cut 3. The seven (7) composited samples, the field duplicate, the reference sample, and a control were subjected to chemical analysis of sediments and elutriates. The material from the Entrance Channel and Bar Cut 3 were deemed acceptable for ocean disposal; however, the number of samples taken from the Mayport Turning Basin did not meet SERIM requirements and would require further sampling and testing.

The composited samples were tested for metals, pesticides, PCB congeners, PAHs, organotins, oil and grease, total sulfide, ammonia, cyanide, specific gravity, bulk density, Atterberg limits, TOC, grain size and percent moisture, bioassay, and bioaccumulation testing. Methods used are detailed in Section 4, Methods and Materials, of the 2009 Report. The results of these analyses are presented in section 5.0, Results and Findings, of the 2009 Report. The material met the applicable ocean disposal criteria and was deemed acceptable for ocean disposal. The material from the basin is described as dark gray silty fine **sand, dark gray silt with traces of fine sand, and dark gray clay with traces of sand.**

Chemical Analysis of the Liquid Phase.

(1) *Heavy Metals.* Metals analysis results are displayed in Table 5 of the 2009 Report. No metals exceeded USEPA Water Quality Criteria for Priority Toxic Pollutants levels. Arsenic found in the elutriate samples ranged from 2.6 µg/L to 32.6 µg/L (E-MP08-5), and reference and control samples yielded 5.9µg/L and 1.9µg/L Arsenic, respectively. Mercury and Nickel were detected at low levels.

(2) *Pesticides, PCBs, and PAHs.* Pesticides, PCB congeners, PAHs, and organotins were not detected at or above target detection limits specified in the Statement of Work. (2009 Report: Tables 6-9).

Suspended Particulate Phase Evaluation.

Bioassays were conducted on elutriates of sediments and sediments from all samples and reference stations.

(1) *Americamysis bahia.* Survival of *A. bahia* was 94 percent in the control seawater (0 percent elutriate) and 92-94 percent in the elutriate control sediment (100 percent control elutriate). Test station sample survivorship ranged from 84-94% with the exception of E-MP08-1, 14%, which exhibited a statistically significant difference from the control for 100 percent solution (2009: Table 14-16).

(2) *Menidia beryllina.* Survivorship of *M. beryllina* was 100 percent in the control water (0 percent elutriate) and 98 to 100 percent in the control sediment (100 percent elutriate). Test station sample survivorship was wide ranging. E-MP08-1, 3, 7, and 8 were significantly different than the control (2009 Report: Table 17-19).

(3) *Arbacia punctulata.* Fertilization of A. punctulata gametes was 78 percent in the control water (0 percent concentration) and 85 percent (10 percent concentration), 79 percent (50 percent concentration), and 82 percent (100 percent concentration). Zone samples ranged from 66 to 74 percent with E-MP08-1 statistically different than the rest at 27 percent (2009 Report: Table 21-22). All zones had normal development.

Evaluation of the results of these tests was performed using the ADDAMS model to predict dilution at the disposal site and determine if disposal of the DM exceeded the limiting permissible concentration (LPC). The results of this testing are presented in Section 5.7 and model outputs are provided in Appendix G. The ADDAMS model results indicate that toxicity criteria were exceeded at a depth of 35 feet using the LC_{50} of 27 percent for M. beryllina. Toxicity criteria were met for both *A. bahia* and *A. punctulata.* Due to the minimal amount of metal and chemical contaminants, the ADDAMS model was not needed to be performed for Water Quality criteria.

Solid Phase Toxicity Evaluation.

Sediment bioassays were conducted using two species, *Americamyis Bahia* (*A. bahia*) and *Leptocheirus plumulosus* (*L. plumulosus*). The results of the testing are presented in Appendix D of the 2009 Report. The results of the bioassays were evaluated by comparing the mortality of each species at each sample station to the average of mortality of the species at the reference station.

(1) *Americamysis bahia (A. bahia)* survivorship was 91 percent in the laboratory control sediment and 84 percent in the reference sediment, RS-MP08 (Table 24). Survivorship of *A. bahia* in site sediments ranged from *75* percent (E-MP08-03 and E-MP08-04 in the Mayport Entrance Channel) to 92 percent (E-MP08-06 Bar Cut 3). Survival of *A. bahia* in the reference sediment was only significantly different (p=0.05) from survival in samples E-MP08-03.

(2) *Leptocheirus plumulosus. (L. plumulosus)* survivorship was 95 percent in the laboratory control sediment and 91 percent in the reference sediment (Table 26). Survivorship of *L. plumulosus* in the site sediments ranged from 70 percent (E-MP08-04 Mayport Entrance Channel) to 91 percent (E-MP08-02 and E-MP08-05: East Turning Basin and Mayport Entrance Channel respectively).

L. plumulosus was retested for zones E-MP08-4 and RS-MP09 and showed that zone 4 did not have significantly lower survival than the offshore reference sample.

Solid Phase Bioaccumulation Evaluation.

Bioaccumulation tests were conducted using two species, *Macoma nasuta* and *Nireis verens.* Tissue concentrations were compared against the Food and Drug Administration's (FDA) Published Levels of Concern for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food. None of the metals for which FDA actions levels exist were found above these levels.

(1) *Macoma nasuta. M. nasuta* survivorship in the laboratory control sediment was 91 percent and 90 percent in the offshore reference sediment. Survival of *M. nasuta* in the site

sediments ranged from 77 percent (E-MP09-04) to 93 percent (E-MP09-05) (Table 28). E-MP09-04 and E-MP09-03 duplicate were significantly different from the control sediment.

(2) *Nereis virens.* Data for the survival of *N. virens* in the bioaccumulation tests are also presented in Table 28. *N. virens* survivorship in the laboratory control sediment was 98 percent. Survival of *N. virens* in the site sediments ranged from 85 percent (E-MP09-6) to 98 percent (RS-MP09-3).

These results show that the solid phase of the material does not cause significant mortality and meets the solid phase toxicity criteria of Sections 227.6 and 227.27. The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in the 2009 Report.

Based on comparisons with FDA Action Levels and consideration of the factors above, the data indicate no significant potential for bio-accumulation from the dredged material. Consequently, it is determined that there is no potential for undesirable effects due to bio-accumulation as a result of the presence of individual chemicals or of the solid phase of the dredged material as a whole. Therefore, it is concluded that the solid phase of the material proposed for disposal meets the ocean disposal criteria at 40 CFR §227.6(c)(3) and §227.27(b). The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in the referenced Final Report.

2007 Evaluation

Twenty-seven (27) sub-zone sample stations in nine zones were sampled in the entrance channel, turning basin, destroyer slip and emergency boat basin. The nine composited Naval Station samples, the duplicate sample, the reference station composite and the control sample were tested for metals, pesticides, PCB congeners, PAHs, organotins, oil and grease, total sulfide, ammonia, cyanide, specific gravity, bulk density, Atterberg limits, TOC, grain size and percent moisture.Composited samples from Zones 1 through 5 were subjected to chemical testing only. Composited samples from Zones 6 through 9 were subjected to full chemical, bioassay and bioaccumulation testing.Methods used are detailed in Section 2.0, Methods and Materials, of the 2007 Report. The results of these analyses are presented in section 3.0, Results and Discussion, of the 2007 Report. The material met the applicable ocean disposal criteria and was deemed acceptable for ocean disposal. The material from the basin is described as dark gray silty fine sand, dark gray silt with traces of fine sand, and dark gray clay with traces of sand.

Chemical Analysis of Sediments.

(1) *Heavy metals.* Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Ag and Zn levels were evaluated in all sediment samples. Metals analysis results are displayed in Table 5 of the 2007 Report. Heavy metals were detected in each sample, although the levels varied. They were slightly elevated relative to the reference stations. However, none appear to be elevated above expected levels for saline sediments, nor do any of the levels reported appear to be of concern in view of the dilution of the dredged material, its effluent, and the characteristic of fine grained sediments to retain adsorbed metals.

(2) *Pesticides, PCBs, and PAHs.* Pesticides were not detected in sediments from any station. Trace levels of PCB 206 were detected in the reference sample and samples 2 through 8. No

other PCBs were detected in any of the samples. Trace levels of PAHs were detected in samples 2 through 8. However, none appear to be elevated above expected levels for an active port facility, nor do any of the levels reported appear to be of concern (2007 Report, tables 6, 7 and 8).

(3) *Organotin.* Organotin analysis results are displayed in Table 9 of the 2007 Report. Trace levels of Organotin were detected in samples 6 and 7. Levels of organotin compounds in the sediments were below the detection limit (0.010ppm dry wgt.) in all other samples.

Chemical Analysis of the Liquid Phase.

(1) *Heavy Metals.* Metals analysis results are displayed in Table 11 of the 2007 Report. Levels of heavy metals in the elutriate varied between stations. They were slightly elevated relative to the reference stations. However, none appear to be elevated above expected levels for saline sediments, nor do any of the levels reported appear to be of concern. Arsenic was found to be the substance with the greatest potential for exceeding the Water Quality Criteria for Priority Toxic Pollutants during disposal, although elevated levels of copper and zinc were detected as well. To meet applicable water quality criteria the effluent from zone 4 must be diluted to 90.4% of the original concentration. ADDAMS model results indicated that water quality criteria and toxicity criteria were not violated thus they will not exceed criteria levels at any time during disposal.

(2) *Pesticides, PCBs, and PAHs.* Slightly elevated levels of the pesticide toxaphene were dected in each station, although no other pesticides were detected in any of the samples. PCBs and PAHs were not detected in elutriates from any station. (2007 Report, tables 12, 13 and 14).

(3) *Organotin.* Organotin analysis results are displayed in Table 15 of the 2007 Report. Low levels of Di-n-butylin were detected in the control sample, the reference sample, sample 8, 9, and duplicate sample 9.Organotin levels were below the detection limit of 0.010 ug/l in all other samples.

2002 Evaluation

Previous evaluations in 2002 included 18 sediment samples taken at stations in the Entrance Channel, Mayport Turning Basin and Destroyer Slip. The Emergency Boat Basin was not included in this evaluation. The 18 samples were composited into 6 samples and analyzed for grain size and settling rate as described below (see map at Fig. 2A 2002 Report). Two reference stations in proximity to the ODMDS were also sampled. The reference stations were numbered RS-MP02-A and B, hereafter referred to in this report as reference stations A-B.

Samples from all 6 composited samples, the reference sample and a control were subjected to chemical analysis of sediments and elutriates and bioassays of sediments and elutriates. Methods used are detailed in Section 2.0, Methods and Materials, of the 2002 Report. The results of these analyses are presented in section 3.0, Results and Discussion, of the 2002 Report. The material met the applicable ocean disposal criteria and was deemed acceptable for ocean disposal with the exception of the Destroyer Slip (zone 5) which failed the *M. bahia* solid phase bioassay. Material from the Destroyer Slip was placed in an upland site adjacent to the airfield at NS

Mayport. Until the Destroyer Slip is retested and found to be acceptable, material from this area will be disposed of at an upland site.

Chemical Analysis Sediment.

(1) *Heavy metals.* Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Ar, Tl and Zn levels were evaluated in all sediment samples. Aluminum, arsenic, chromium, copper, iron, lead, nickel and zinc were found at levels higher than the reference station. Cadmium, mercury and nickel were either undetectable or found at very low levels, and silver and cyanide were not detected in any of the samples. Metals analysis results are displayed in Table 9 of the 2002 Report. Levels of heavy metals in the sediments varied between stations. They were slightly elevated relative to the reference stations. However, none appear to be elevated above expected levels for saline sediments, nor do any of the levels reported appear to be of concern in view of the dilution of the dredged material, its effluent, and the characteristic of fine grained sediments to retain adsorbed metals. Ammonia levels ranged from 33.1 to 233 µg/kg (reference station: 65.4 µg/kg). Percent TOC ranged from 1.7 to 4.1 (reference station: 0.24 percent). Oil and grease results varied from below detection limit for the reference station to 140 mg/Kg for sample E-MP02-4 (Center Basin).

(2) *Pesticides, PCBs, and PAHs.* No pesticides or PCBs were detected in sediments from any station. Trace amounts of PAHs were detected at some stations but not at concentrations high enough to cause concern. PAH concentrations ranged from 5.2 µg/kg (Benzo(a)pyrene at station 1) to 29 µg/kg (Chrysene at stations 2 and 3). The reference station sample had PAH levels of 2.6 µg/k to 9.3 µg/kg for nine of the 16 PAHs evaluated (2002 Report, tables 10 and 11).

(3) *Organotin.* Organotin analysis results are displayed in Table 12 of the 2002 Report. Levels of organotin compounds in the sediments varied between stations. They were slightly elevated relative to the reference stations at stations 2, 3, 5, and 6. Monobutyl tin was found at station 6 at a level of 8.3 µg/kg dry weight. Tributyl tin was found at stations 2, 3 and 5 at levels from 12 µg/kg to 18 µg/kg. The reference sample had monobutyl tin at a level of 2.9 µg/kg and tributyl tin at 3.9 µg/kg. However, none appear to be elevated above expected levels for an active port facility, nor do any of the levels reported appear to be of concern in view of the dilution of the dredged material, its effluent, and the rapid degradation of organotin compounds in a marine environment.

Chemical Analysis of the Liquid Phase.

(1) *Heavy Metals.* Metals analysis results are displayed in Table 14 of the 2002 Report. Levels of heavy metals in the elutriate varied between stations. They were slightly elevated relative to the reference stations. However, no metals are elevated above expected levels for saline sediments, nor are any of the levels reported likely to result in an exceedence of applicable water quality criteria during disposal. Arsenic was found to be the substance with the greatest potential for exceeding the Water Quality Criteria for Priority Toxic Pollutants, during disposal. ADDAMS model results indicated that water quality criteria and the toxicity criteria were not violated thus they will not exceed at any time during disposal.

(2) *Pesticides, PCBs, and PAHs.* No pesticides or PCBs were detected in elutriates from any station. (2002 Report, Tables 15 and 16) and only slight levels of PAHs were detected in some of the sediments (Tables 10). Ammonia levels ranged from 0.060 mg/L for the reference site water to 21.0 mg/L for sample E-MP02-5 (Destroyer Slip Station) was below detection limit for the reference site water to 22.2 mg/L for sample E-MP02-5 (Destroyer Slip Station).

(3) *Organotin.* Organotin analysis results are displayed in Table 17 of the 2002 Report. Levels of organotin compounds in the elutriates varied between stations. They were slightly elevated relative to the reference station. However, none appear to be elevated above expected levels for an active port facility, nor do any of the levels reported appear to be of concern in view of the dilution of the dredged material, its effluent, and the rapid degradation of organotin compounds in a marine environment. These levels of organotins are below the Federal recommended water quality criteria for Tributyltin of 0.38 ug/l and are unlikely to result in an exceedence of applicable water quality criteria during disposal operations.

Suspended Particulate Phase Evaluation.

(1) *Mysidopsis bahia.* Survival of *M. bahia* was 94 percent in the control water (0 percent elutriate) and 90 percent in the elutriate control sediment (100 percent control elutriate). Test station sample survivorship ranged from 78 percent (50 percent exposure for E-MP02-05 Destroyer Slip station) to 96 percent (10 percent exposure for Sample E-MP02-02 Carrier Dock Station) (Table 22). Based on the results of the survival counts, there were no significant differences (P=0.05) in the survivorship of *M. bahia* between the control water (0 percent elutriate) or control sediment and the sample stations for the 100 percent elutriate concentrations prepared from the site sediments (Table 23).

(2) *Menidia beryllina.* Survivorship of *M. beryllina* was 98 percent in both the control water (0 percent elutriate) and the control sediment (100 percent elutriate). Test station sample survivorship ranged from 88 percent (E-MP02-04 Center Basin Station) to 100 percent (E-MP02-01 Entrance Channel Station, E-MP02-04 Center Basin Station 50 percent exposures, E-MP02-06 Foxtrot Pier Station10 and 50 percent exposures, and E-MP02-03 DUP West Dock Station, 10, 50, and 100 percent elutriate exposures) (Table 24). Based on the results of the survival counts, there were no significant differences (P=0.05) between the survivorship of *M. beryllina* in the control water (0 percent elutriate) or control sediment (100 percent elutriate) and survivorship in the 100 percent elutriate concentration prepared from the site sediments (Table 25).

(3) *Lytechinus variegates.* Fertilization of *L. variegatus* gametes was 64 percent in the control water (0 percent elutriate) and 67 percent in the 100 percent elutriate control sediment. Fertilization of *L. variegatus* gametes in the site samples ranged from 59 percent (50 percent elutriate from sample station E-MP02-02 Carrier Dock Station) to 72 percent (10 percent elutriate from sample station E-MP02-03 West Dock Station) (Table 26). There were no significant differences (P=0.05) in the fertilization of *L. variegatus* between the control water (0 percent elutriate) and control sediment (100 percent elutriate) when compared to the Mayport sample stations (Table 27).

Evaluation of the results of these tests was performed using the ADDAMS model to predict dilution at the disposal site and determine if disposal of the DM exceeded the limiting

permissible concentration (LPC). The results of this testing are presented in Tables 22-28 of the 2002 Report. The ADDAMS model results indicate water quality criteria will not exceed at any time during disposal. Liquid phase bioassays resulted in LC_{50} values exceeding 100 percent elutriate. The ADDAMS model results indicate dilution of the liquid phase will be more than adequate.

Solid Phase Toxicity Evaluation (2002 Report: Tables 29-32).

(1) *Mysidopsis bahia M. bahia* survivorship was 97 percent in the laboratory control sediment and 85 percent in the reference sediment, RS-MP02 Carrier Dock Station (Table 29). Survivorship of *M. bahia* in site sediments ranged from 23 percent (Station E-MP02-05 Destroyer Ship) to 86 percent (Station E-MP02-01 Entrance Channel). Surviving *M. bahia* appeared healthy at test termination. *M. bahia* survivorship between replicates was relatively uniform (Appendix D-6). Statistical analysis indicated that the survival of *M. bahia* in the laboratory control sediment was not significantly different (P=0.05) from survival in any samples except E-MP02-04 Center Basin Station and E-MP02-05 Destroyer Ship Station (Table 30). Survival of *M. bahia* in the reference sediment was only significantly different (p=0.05) from survival in samples E-MP02-05 Destroyer Slip Station (Table 30).

(2) *Leptocheirus plumulosus. L. plumulosus* survivorship was 97 percent in the laboratory control sediment and 88 percent in the reference sediment (Table 31). Survivorship of *L. plumulosus* in the site sediments ranged from 86 percent (E-MP02-05 Destroyer Slip Station) to 94 percent (E-MP02-03 West Dock Station).Statistical analysis using Dunnett's T-test indicated that the survival of *L. plumulosus* in the laboratory control sediment was significantly different (P=0.05) from survival in one Mayport sample, E-MP02-05 Destroyer Slip Station (Table 32). Survival of *L. plumulosus* in the reference sediment was not statistically different from any site samples (Table 32). Statistical analysis using Dunnett's T-test indicated that the survival of *L. plumulosus* in the laboratory control sediment was significantly different (P=0.05) from survival in one Mayport sample, E-MP02-05 Destroyer Slip Station (Table 32). Survival of *L. plumulosus* in the reference sediment was not statistically different from any site samples (Table 32).

(3) *Macoma nasuta. M. nasuta* survivorship in the laboratory control sediment was 73 percent. Survival of *M. nasuta* in the site sediments ranged from 54 percent (E-MP02-05 Destroyer Slip Station) to 68 percent (RS-MP02 Carrier Dock Station) (Table 33). Survival was somewhat lower than observed in prior tests, and may have been due to the modest increase in loading. Control survival at recommended loading are typically greater than 80 percent, and generally range from 85-90 plus percent. Some additional mortality (but less than 10 percent incremental) was anticipated at the higher loading rate based upon past data (80 percent control survival) and recommendations from the supplier. Based upon these factors, the increased loading was chosen as a cost effective approach to obtaining the additional tissue required for this investigation. Adequate mass of *M. nasuta* tissue was available for chemical analyses, if required.

With the exception of *M. bahia* at Destroyer Slip Station, all of the results show that the solid phase of the material does not cause significant mortality and meets the solid phase toxicity criteria of Sections 227.6 and 227.27. The Destroyer Slip Station sediments did not meet the requirements for ocean disposal and this area has been withdrawn from the application. In

accordance with the 1991 Green Book, if the mortality for *Mysidopsis Bahia* exceeds the reference station by more than 10 percent and the data is statistically significant, the sediment does not meet the criteria for ocean disposal. The sediment bioassays documented a reference station mortality of 25 percent. The difference in mortality was greater than 35 percent at station 5 and statistically significant. All other sample stations were within the standard.

Solid Phase Bioaccumulation Evaluation. Bioaccumulation tests were conducted using two species, *Macoma nasuta* and *Nireis verens*. Tissue concentrations were compared against the Food and Drug Administration (FDA) Published Levels of Concern for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food. None of the metals for which there are FDA actions levels were found above these levels.

(1) *Macoma nasuta. M. nasuta* survivorship in the laboratory control sediment was 73 percent. Survival of *M. nasuta* in the site sediments ranged from 54 percent (E-MP02-05 Destroyer Slip Station) to 68 percent (RS-MP02 Carrier Dock Station) (Table 33). Survival was somewhat lower than observed in prior tests, and may have been due to the modest increase in loading. Control survival at recommended loading are typically greater than 80 percent and generally range from 85-90 plus percent. Control survival is highly dependent upon the status of the organisms when received from the field. Some additional mortality (but less than 10 percent incremental) was anticipated at the higher loading rate based upon past data (80 percent control survival) and recommendations from the supplier. Based upon these factors, the increased loading was chosen as a cost effective approach to obtaining the additional tissue required for this investigation. Adequate mass of *M. nasuta* tissue was available for chemical analyses, if required.

(2) *Nereis virens.* Data for the survival of *N. virens* in the bioaccumulation tests are also presented in Table 33. *N. virens* survivorship in the laboratory control sediment was 97 percent. Survival of *N. virens* in the site sediments ranged from 62 percent (E-MP02-03 West Dock Station) to 95 percent (RS-MP02 Carrier Dock Station) (Table 33). It was noted upon takedown of the tests that survival in Replicate C of E-MP02-03 West Dock Station was limited to one organism. However, survival in the other replicates for the same sample was 17, 14, 15, and 15. It is anticipated that an error was made during the organism loading step of the test initiation. If tissue analyses are required, it is recommended that the tissues for all replicates be combined and random aliquots be collected as outlined in the test guidance (USEPA-503/8-91/001, February 1991). Adequate mass of *N. virens* tissue was available for chemical analyses in the remaining samples, if required.

Mortality results in the 28-day bioaccumulation phase are not comparable to results in the 10-day bioassay procedure, and are for information purposes only, and are not used for tier three evaluation purposes. Based on comparisons with FDA Action Levels and consideration of the factors above, the data indicate no significant potential for bioaccumulation from the dredged material. Consequently, it is determined that there is no potential for undesirable effects due to bioaccumulation as a result of the presence of individual chemicals or of the solid phase of the dredged material as a whole. Therefore, it is concluded that the solid phase of the material proposed for disposal meets the ocean disposal criteria at 40 CFR §227.6(c)(3) and §227.27(b). The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in the referenced 2002 Report.

Tissue Data. Tables 18 and 19 of the referenced 2002 Report lists the metals found in the tissue samples and their concentrations. Tissues of *M. nasuta* and *N. virens* grown for 28 days in

contact with Mayport sediments were analyzed for arsenic, cadmium, chromium, copper, lead, mercury, nickel, tin, zinc and PAHs. Detectable levels of all nine metals were found in tissues from both species. No PAHs were detected in any of the tissue samples. Only mercury and tin were found to be significantly higher than levels found in the reference sample. Tin was found to be higher in *M. nasuta* tissue from station 1. Mercury was found to be higher in *N. virens* tissues from all stations. Because the data suggests that bio-accumulation of contaminants in the dredged material may, in some cases exceed that in the reference material the eight factors in Section 6.3 of the Green Book have were addressed. The conclusion of the 2002 evaluation was that the tissue concentrations were not significant.

1994 Evaluation

The Final Consolidated Report for Obtaining and Analyzing Sediment Samples, Water Samples, and Bioassay Samples from Mayport Harbor, Florida dated March 1994 (1994 Report) documents the analytical results derived from 15 sediment samples taken at stations in the Entrance Channel, Mayport Turning Basin and Destroyer Slip. The 15 samples were composited into 8 samples and analyzed for grain size and settling rate as described below (see map at Fig. 2 1994 Report, Vol. I, page 2-3). Four reference stations in proximity to the ODMDS were also sampled. The reference stations were numbered RS-MP94-A to D, hereafter referred to in this report as reference stations A-D. The composited reference sample was numbered RS-MP93-1 Samples from 8 stations and a control were subjected to chemical analysis of sediments and elutriate, bioassays of sediments and elutriates, and tissue analysis of animals exposed to the sediments to determine bioaccumulation potential. Methods used are detailed in Section 2.0, Methods and Materials, of the 1994 Report, Vol. I. The results of these analyses are presented in section 3.0, Results and Discussion, of the 1994 Report, Vol. I. The material met the applicable criteria and was deemed acceptable for ocean disposal. Analytical results are further reviewed below as appropriate.

Chemical Analysis of Sediments.

(1) *Heavy metals.* Al, Sb, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Se, Ar, Tl and Zn levels were evaluated in all sediment samples. Metals analysis results are displayed in Tables 4 and 6 (pages 3-6 to 3-8 and page 3-10, of the 1994 Report, Vol. I) Levels of heavy metals in the sediments varied between stations. They were slightly elevated relative to the reference stations. However, none appear to be elevated above expected levels for saline sediments, nor do any of the levels reported appear to be of concern in view of the dilution of the dredged material, its effluent, and the characteristic of fine grained sediments to retain adsorbed metals.

(2) *Nutrients, Pesticides, PCBs, PAHs, Phenols and Phthalates.* Ammonia levels varied from 208 ug/g at station 4 to 412 ug/g at station 7. No pesticides, PAHs, or phenolic compounds were detected in sediments from any station (1994 Report, Vol. I, TTables 7-10A).

Detection limits for pesticides ranged from 3 ug/kg to 400 ug/kg dry weight. The control and reference samples had pesticide detection limits of 3 ug/kg to 120 ug/kg. Detection limits for PCBs ranged from 400 ug/kg to 1400 ug/kg dry weight. The control and reference samples had PCB detection limits of 400 ug/kg. Detection limits for PAHs ranged from 70 ug/kg to 240 ug/kg dry weight. The control and reference samples had detection limits for PAHs of 58 ug/kg to 60 ug/kg. Phenolic compounds had detection limits that ranged from 370 ug/kg to 6000 ug/kg dry weight. The control and reference samples had detection limits for phenols of 291 ug/kg to

1560 ug/kg. Phthalates were detected at stations 1, 2, 4, 5, 7, 8 and 8 duplicate. Phthalate levels ranged from 4600 ug/kg dry weight at station 8 (bis (2Ethylhexyl)phathalate) to 6700 ug/kg dry weight at station 7 (bis (2Ethylhexyl)phathalate).

Chemical Analysis of the Liquid Phase. No elutriate analysis was performed in this evaluation.

Bioassays were conducted on elutriates of sediments and sediments from all samples and reference stations.

Suspended Particulate Phase Evaluation.

Elutriate bioassays were run for 96 hours using *Mysidopsis Bahia*, and *Menidia beryllina*. A fertilization test using sea urchin eggs (*Lytechinus variegatus*) was also conducted. Tests for all three species were conducted in 0, 10, 50 and 100 percent concentration of elutriate. Evaluation of the results of these tests was performed using the ADDAMS model to predict dilution at the disposal site and determine if disposal of the DM would exceed the limiting permissible concentration (LPC). The results of this testing are presented in tables 11-16 of the 1994 Report, Vol. I, beginning on pages 3-30. Results were adequate.

Solid Phase Toxicity Evaluation.

Sediment bioassays were conducted using two species, *Mysidopsis Bahia* and *Leptocheirus plumulosus*. The results of the testing are presented in tables 17-19 beginning on pages 3-42 of the 1994 Report, Vol. I. The results of the bioassays were evaluated by comparing the mortality of each species at each sample station to the average of mortality of the species at the reference station.

The sediment bioassays produced a reference station *Mysidopsis Bahia* mortality of 21%. All sample stations had mortality results that were less than the reference average and therefore all sample stations meet or exceed the criteria for ocean disposal based on the *Mysidopsis Bahia* bioassays.

In accordance with the 1991 Green Book, if the mortality for *Leptocheirus plumulosus* exceeds the reference station by more than 20% and the data is statistically significant, the sediment does not meet the criteria for ocean disposal. The sediment bioassays documented a reference station mortality of 10%. Mortality at stations 4 and 6 in NS Mayport exceeded the reference, by more than 20%. The difference in mortality was not statistically significant at either station. Sample stations 1, 2, 3, 5, 7, and 8 were all within the standard.

Solid Phase Bioaccumulation tests were not performed for this evaluation.

2.2.3 Changes since Last Testing

During the time since the previous concurrence there does not appear to be any recent (post-2008) substantive change in the physical or chemical composition of the candidate material. Information from several databases maintained by the USEPA, including TRI, BRS, RCIS, ERNS, and RMP, has been reviewed. There has been no major changes since the last evaluation, no major spills, major industrial development in the Port's watershed, regulatory efforts or

analytical/contaminate detection/QA-QC considerations. A review of National Response Center records indicates no reported incidents since 2003. Although there have been several minor spills of petroleum products these were rapidly contained and cleaned up before significant environmental impacts could occur. There have been no significant changes in landside activities since the last evaluation.

3.0 Water Column Determinations (Tiers II-IV)

3.1 Evaluation of the Liquid Phase – Water Quality Criteria
(2010 Report: Tables 21, 22, and 23)

The liquid phase of the material was evaluated for compliance with Sections 227.6(c)(1) and 227.27(a). There are applicable marine water quality criteria for constituents in the material, including listed constituents, and the applicable marine water quality criteria were not exceeded after initial mixing. The CCC for Arsenic, Copper, and Chromium was exceeded in the original testing but was not exceeded in the retested chemical analysis. Since the original Arsenic values did not use the reductive oxidation cleanup procedure, the values obtained in the original analysis are not accurate. Since water quality criteria were not exceeded, ADDAMS model runs are not required. Please refer to pages 35 and 36 of the 2010 Report for the chemical analysis of the original and retested elutriate samples. Please refer to the summary of Tables 21, 22, and 23 below from the 2010 Report for the elutriate chemistry testing data from the original elutriate sample data, the retested elutriate sample data, and the data for the ammonia stripped elutriate samples, in that order.

Composite of Tables 21-23 Highlighting As, Cr, and Cu

Metals Analysis of Elutriates

ASI Job # 30-003	EPA Water Quality Criteria	Target DL	E-MP09-1 (Units: ug/L)		E-MP09-2 (Units: ug/L)		E-MP09-3 (Units: ug/L)		E-MP09-4 (Units: ug/L)		E-MP09-5 Field (Units: ug/L)	
Analytical Lab Code			19382		19382		19382		19382		19382	
Analyte	ug/L	ug/L	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q
Arsenic, total	69	1.0	[redacted]		48		[redacted]		62		[redacted]	
Chromium, total	N/A	1.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Copper, total	4.8	1.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND

Metals Analysis of Chemical Elutriates (Retest)

ASI Job # 30-003R	EPA Water Quality Criteria	Target DL	E-MP09-1 (Units: ug/L)		E-MP09-2 (Units: ug/L)		E-MP09-4 (Units: ug/L)		E-MP09-3 (Units: ug/L)		Field Split/ Zone 3 (Units: ug/L)	
Analytical Lab Code			20100396		20100397		20100399		20100398		20100400	
Analyte	ug/L	ug/L	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q
Arsenic, total	69	1.0	36.2		16.3		37.0		51.0		51.6	
Chromium, total	N/A	1.0	0.57		0.48		0.51		0.63		0.66	
Copper, total	4.8	1.0	0.314		0.308		0.296		0.356		0.444	

Metals Analysis of Biological Elutriates, Normal and Ammonia Stripped Samples

ASI Job # 30-003R	EPA Water Quality Criteria	Target DL	E-MP09-1 (Normal)		E-MP09-1 (NH_3 Stripped)		E-MP09-2 (Normal)		E-MP09-2 (NH_3 Stripped)		E-MP09-4 (Normal)		E-MP09-4 (NH_3 Stripped)	
			(Units: ug/L)		(Units: ug/L)		(Units: ug/L)		(Units: ug/L)		(Units: ug/L)		(Units: ug/L)	
ASI Sample ID			20100409		20100404		20100410		20100405		20100412		20100407	
Analyte	ug/L	ug/L	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q	Elutriate	Q
Arsenic, total	69	1.0	19.8		33.6		16.6		18.1		20.5		34.2	
Chromium, total	N/A	1.0	0.58		1.44		0.47		1.44		0.31	J	1.20	
Copper, total	4.8	1.0	0.676		1.330		0.492		1.450		0.412		0.77	

[redacted] Elevated Contaminant Concentration(s) *

3.2 Evaluation of the Liquid and Suspended Particulate Phase

In addition, liquid phase bioassays run as part of the suspended particulate phase on three appropriate sensitive marine organisms: *A. bahia*, *M. beryllina*, and *M. edulis,* show that after initial mixing (as determined under 40 CFR 227.29(a)(2)), the liquid phase of the material would exceed a toxicity threshold of 0.01 of a concentration shown to be acutely toxic to appropriate sensitive marine organisms. Please refer to Table 15 on pages 53-55 of the 2010 Report.

Ammonia Toxicity

Since all sediment and elutriate samples had elevated levels of ammonia, USACE decided to conduct additional testing to determine whether the cause for the toxicity was due to ammonia after consultation with the USEPA and USACE ERDC. The USACE, EPA Region IV, ERDC Environmental Laboratory, and Aqua Survey, Inc. decided to perform Tier IV testing to determine ammonia toxicity. Four ammonia stripping methods were evaluated: the pH evaluation method, an algae method using *olva*, a Zeolite/EDTA method, and the Ferretti method using a thin layer of sediment and aeration. The pH method was preferred due to time and sample quantities needed to run the test. The pH removal protocol was originally used by EA Engineering for Mobile Harbor and is described in Section H. of Part 3, "Suspended Particulate Phase Retest" on page 18 of the 2010 Report. In accordance with EPA recommendations, ammonia stripped samples for each zone was run alongside a normal elutriate bioassay test run for each species. *M. beryllina* and *M. edulis* displayed survival numbers close to that of the control in the ammonia purged elutriate samples. However, the results for *Americamysis bahia* (*A. bahia*) displayed improved survival in the ammonia purged elutriate samples but did not clearly indicate ammonia to be the sole contributor of toxicity. Additional testing of *A. bahia* was not pursued because the original LC_{50} (65.2 percent for E-MP09-03) provided adequate disposal quantities when entered into the STFATE module of the ADDAMS model.

Application Factors (AF)

Having illustrated that ammonia was the source of the toxicity for *M. beryllina* and *M. edulis* for all zones, the USACE is proposing the use of AF 0.05 for ammonia toxicity for the STFATE Module. However, USACE does not propose a change to the AF for *A. bahia* which will use the AF 0.01 for general toxicity. The DRAFT ERDC Literature Review references the EPA Sediment Criteria Subcommittee of the Ecological Processes and Effects Committee (Subcommittee), Scientific Advisory Board Report, "Review of a Testing Manual for Evaluation of Dredged Material Proposed for Ocean Disposal" dated January 9, 1992 wherein specific application factors are assigned to contaminates based on marine or freshwater systems and derived by dividing the "safe" concentration by the 96 hour LC_{50}. The Subcommittee recommends that a "safe" Marine Water AF for ammonia toxicity is 0.1. The AF 0.05 is more protective than 0.1 and is also justified by the historical 1972 "Blue Book" guidance which allowed 0.05 for nonpersistent wastes and 0.01 for persistent wastes.

Ammonia toxicity is uniquely modeled as a result of the fact that in both its ionized and unionized forms, ammonia is naturally stripped from the sediments and chemically changes into other compounds in the presence of oxygen. Thus the impact of ammonia toxicity is minimized with dilution and aeration making it a less persistent toxicant.

Chemical Analysis

Additional chemical analysis was performed to determine whether dissolved metals remained in solution during the ammonia purge thereby isolating the toxicity cause to ammonia loss and not metal(s) loss. There was not a significant reduction of metals as a result of the ammonia purge protocol by pH adjustment.

Accordingly, it is concluded that the liquid phase of the material is in compliance with 40 CFR 227.6(c)(1) and 227.27(a). The specific test results and technical analysis of the data underlying this conclusion are described in tables 20 through 23 of the 2010 Report.

Please note, some of the metals increased in concentration after the ammonia-stripping process, it is hypothesized that when NaOH was added to bring the pH up to 10-11, some of the metals were precipitated as their hydroxide salts. Using the strong acid, 6M HCl, to bring the pH back to the normal elutriate pH of 8 resolubilized the metals, and pulled additional metals off the solids and into solution. Contamination and concentration due to evaporation are not suspected for this change, a factor of two to four.

ADDAMS STFATE Results (Tab 2 ANAMAR ADDAMS Modeling Report for 2010 Report Data and Tab 3 DRAFT USACE STFATE ADDAMS Model Report)

Additional modeling was completed by USACE, Jacksonville District, Engineering Division, Water Resources Engineering Branch to evaluate the parts of the project under mechanical and hydraulic barge types, for both Jacksonville and Fernandina Beach ODMDS. Since the USACE did not test the sand material beneath the silt in the Mayport Turning Basin, the sand layer is not characterized by the new testing. As a result, USACE modeled the E-MP08 zones for both Jacksonville and Fernandina ODMDS.

The STFATE module of the ADDAMS model was run using the lowest Limiting Permissible Concentration (LPC) from both the 2010 Report and the 2009 Report for each sampling zone and project reach. The optimum load sizes and relative disposal release zones are compiled in the DRAFT USACE STFATE ADDAMS Model Report. Model runs used the 0.05 AF with the LC_{50}/EC_{50} for *M. beryllina* and *M. edulis*, the 0.01 AF with the LC_{50} for *A. bahia* from the 2010 Report, and the 0.01 AF with the LC_{50} for M. beryllina from Zone 1, E-MP08-1. Please refer to the 2008 Report, Table 23. The LCP calculated from E-MP08-1 was the most restrictive parameter and limited the maximum load size for the Western of Station 9+65 in the Mayport Turning Basin. The delineation is shown in the WAR Sampling Zone Diagram under Tab 4 of the 2010 Evaluation. The resulting load sizes and disposal release zones are restricted in the west half of the Mayport Turning Basin when using a hydraulic dredge and placing material in either the Jacksonville ODMDS or Fernandina Beach ODMDS. The load sizes were modeled for the largest possible dredge in its classification. If smaller hoppers or barges/scows are used, less restrictions will apply.

Please refer to the ADDAMS Modeling Report for the 2010 Report Data (Tab 2) and the DRAFT USACE ADDAMS Model Report (Tab 3) for the parameter input tables developed with the aid of the Navigation Branch, Operations Division and using results presented in the Jacksonville ODMDS Site Management and Monitoring Plan (SMMP) (2007), the Fernandina Beach ODMDS SMMP (2010), the Jacksonville ODMDS Benthic Surveys: 1995 and 1998 report (1998), both accessed on the USEPA Region IV website, and sample concentration data provided by Aqua Survey, Inc. and Water and Air Research.

The modeling performed by USACE encompasses the parameters analyzed by the 2010 report and the findings state that all Mayport Turning Basin DM is acceptable for disposal at the Jacksonville and Fernandina Beach ODMDS up to 6,000 cubic yards (cy) per load for mechanical dredge types, up to 9,500 cy per load for hopper dredges, and 5,000 cy per load for cuttersuction dredges using a spider barge. The disposal release zones are described in Tab 3 Appendix C for both the Jacksonville and Fernandina Beach ODMDS.

4.0 Benthic Determinations (Tiers II-IV)

The solid phase of the material was evaluated for compliance with Sections 227.6(c)(3) and 227.27(b). This evaluation was made using the results of two specific types of evaluations on the solid phase of the material, one focusing on the acute (10-day) toxicity of the material, and the other focusing on the potential for the material to cause significant adverse effects due to bioaccumulation. Both types of tests used appropriate sensitive benthic marine organisms according to procedures approved by USEPA and the USACE.

4.1 Solid Phase Toxicity Evaluation

Ten-day toxicity tests were conducted on project materials using mysids and amphipods, which are appropriately sensitive benthic marine organisms: *Leptocheirus plumulosus* (*L. plumulosus*) and *Americamysis bahia* (*A. bahia*). These organisms are good predictors of adverse effects to benthic marine communities.

2009 Results

The control and reference had a 97 and 73 percent survival respectively for the retest of *L. plumulosus* and 91 and 84 for *A. bahia*. The percent survival in the Zone 4 retest of L. plumulosus was 94% and ranged from 92 to 73 percent for the original *L. plumulosus* excluding Zone 4 and 92 to 77 for *A. bahia*.

After 10 days of exposure to sediments from Mayport Turning Basin there was no significant difference (P=0.05) in the survival of *Leptocheirus plumulosus* in the laboratory control sediment and reference sediment and all zones. Initial results indicated poor survival of *L. plumulosus* in Zone 4. Zone 4 and reference sediments were rerun and survivorship was well within acceptable limits.

With the exception of initial *L. plumulosus* results in Zone 4 results show that the solid phase of the material does not cause significant mortality and meets the solid phase toxicity criteria of Sections 227.6 and 227.27. Retesting of the Zone 4 sediments indicated the original results were not typical. The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in Table 24 to 27 of the 2009 Report.

2010 Results

The control and reference had a 100 and 96 percent survival respectively for *L. plumulosus* and 96 and 88 for *A. bahia*. The percent survival ranged from 87 to 95 percent for *L. plumulosus* and 88 to 75 for *A. bahia*.

Since Zone 4, E-MP09-4 had a greater than 10% difference from the reference for the *A. bahia* species, statistical significance tests were performed. E-MP09-4 did not fall outside the range of variability of the other survival counts for each zone using Dunnett's Test and was determined to be insignificant. The toxicity of project sediments for both species was within 10 percent of the reference sediment toxicity for mysid shrimp and within 20 percent for amphipods, and was not statistically greater than the reference sediment for either species tested.

These results show that the solid phase of the material does not cause significant mortality and meets the solid phase toxicity criteria of Sections 227.6 and 227.27. The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in the 2010 Report on page 18 and Table 9. Please also find the statistical calculations in the SRT raw data.

4.2 Solid Phase Bioaccumulation Evaluation

2009 Results

Tissue concentrations were compared against the Food and Drug Administrations (FDA) Published Levels of Concern for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food. None of the metals for which there are FDA actions levels were found above these levels. Tables 10 and 11 of the referenced 2009 Report lists the metals found in the tissue samples and their concentrations. Table 12 and 13 show a comparison of each species and FDA action levels, below, also shows the relative levels in the organisms exposed versus the reference. Tissues of *M. nasuta* and *N. virens* grown for 28 days in contact with Mayport Turning Basin sediments were analyzed for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, organotins, pesticides, PCBs and PAHs. Detectable levels of copper, selenium and zinc were found in tissues from *Macoma nasuta*. Detectable levels of arsenic, copper, selenium, zinc, chlordane, and PCBs were found in tissues from *Nereis virens*. Only copper was found to be significantly higher in *M. nasuta* than levels found in the reference sample. Copper was also found to be significantly higher in *N. virens* than levels found in the reference sample. Because the data suggests that bio-accumulation of contaminants in the dredged material may, in some cases exceed that in the reference material the eight factors in Section 6.3 of the Green Book have been addressed below:

1. The number of species in which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference material.

There were two species tested in this evaluation, *Nereis virens* and *Macoma nasuta*. A table showing the results is provided in item 3 below. Both species showed some stations with absolute concentrations of metals in tissues above reference and control sediment.

2. The number of contaminants for which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference.

Only copper was found to be significantly higher in both species than levels found in the reference sample.

3. Magnitude by which the bioaccumulation from the dredged material exceeds bioaccumulation from the reference material.

The source is Table 10 and 11 of referenced 2009 report. The data has been rewritten and provided in percentage amounts over reference on table 1 below.

4. Toxicological importance of the contaminants whose bioaccumulation from the dredged material statistically exceeds bioaccumulation from the reference.

a. Copper (Cu). Cu was detected at levels above detection at in all zones for both species. The range of 2.5 mg/kg to 5.2 mg/kg (wet wt.) is above the reference station values of 2.4 mg/kg (wet wt., M. nasuta). These are low compared to values listed in the literature data summarized in the WES Environmental Residue-Effects Database (ERED at http://www.wes.army.mil/el/ered/index.html#misc). There is no FDA level of concern established.

5. Phylogenetic diversity of the species in which bioaccumulation for the dredged material statistically exceeds bioaccumulation from the reference material.

The species tested were *Macoma nasuta* and *Nereis virens*. These species were recommended in the original 1991 "Evaluation of Dredged Material Proposed for Ocean Disposal" page 12-4, Table 12-1; labeled "Examples of Appropriate Test Species for Determining Potential Bioaccumulation From Whole Sediment Tests". The basic recommendations include requirements that a burrowing polychaete and a deposit feeding bivalve mollusk be tested. The test organisms are important in the region ecologically, represent species that provide adequate biomass for analysis, and are detritus feeders, which ingest sediments.

6. Propensity for the contaminants with statistically significant bioaccumulation to bio-magnify within the aquatic food webs.

According to Table 12 and 13 from the 2009 Report, none of the constituents found in tissues higher than reference were contaminants that have been shown to significantly bio-magnify in the food chain.

7. Magnitude of toxicity and the number and phylogenetic diversity of species exhibiting greater mortality in the dredged material than in the reference material.

Phylogenetic diversity of species is discussed in the response to 5 above. All species selected for testing were selected based in part on their phylogenetic diversity.

Data for the survival of *M. nasuta* and *N. virens* in the bio-accumulation tests are presented in Tables 28 through 30 of the 2009 Report. *M. nasuta* survivorship in the laboratory control sediment was 91 percent. Survival of *M. nasuta* in the site sediments ranged from 77 percent (sample station E-MP09-4) to 93 percent (sample station E-MP09-5).

N. virens survivorship in the laboratory control sediment was 98 percent. Survival of *N. virens* in the site sediments ranged from 85 percent (sample station E-MP08-6) to 98 percent (sample stations E-MP09-3).

Mortality results in the 28-day bioaccumulation phase are not comparable to results in the 10-day bioassay procedure, and are for information purposes only, and are not used for tier three evaluation purposes.

8. Magnitude by which contaminates whose bio-accumulation from the dredged material exceeds that from the reference material also exceed the concentrations found in comparable species living in the vicinity of the proposed disposal site.

Exact comparative values for animals in the NOAA "Mussel Watch" program (source: National Oceanic and Atmospheric Administration (NOAA), 1998 (on-line); "Chemical Contaminants in Oysters and Mussels" by Tom O'Connor; NOAA's State of the Coast Report, Silver Spring, MD: NOAA. URL: http://state_of_coast.noaa.gov/bulletins/html/ccom_05/ccom.html) in the vicinity of the project site were not immediately available.

Overall nationwide trends in the above referenced study are provided on the attached tables. The table provided at table 2 below provides a comparison of dry wt. concentrations. The values for each of the metals that showed statistically significant exceedance of the reference values were as follows for *M. nasuta* dry wt.; Cu at 1.71 ppb, Ag at .17 ppb, and butyltin at 84.32 ppb. For N. virens dry wt.; Al at 107.44 ppb, Hq at .14 ppb, Ag at .18 ppb. Total PAH levels of 160.51 ppb were found in *Macoma* at station E-CH03-12. These values compare favorably with median concentrations reported in table 2.

2010 Results

Tissue concentrations were compared against the Food and Drug Administration (FDA) Published Levels of Concern for Poisonous and Deleterious Substances in Fish and Shellfish for Human Food. None of the analytes for which there are FDA actions levels were found above these levels. Tables 24 and 26 of the referenced 2010 Report lists the analytes found in the tissue samples and their concentrations. Table 1, below, also shows the relative levels in the organisms exposed versus the reference. Tissues of *M. nasuta* and *N. virens* grown for 28 days in contact with Mayport Turning Basin sediments were analyzed for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, organotins, pesticides, pentachlorophenol, PCBs and PAHs. Detectable levels of arsenic, copper, lead, zinc, pesticides, and PCBs were found in tissues from *Macoma nasuta.* Detectable levels of copper, zinc, pesticides, PCBs and PAHs were found in tissues from *Nereis virens.* Only zinc and PCBs were found to be significantly higher in *M. nasuta* than levels found in the reference sample. Pesticides and PAHs were found to be significantly higher in *N. virens* than levels found in the reference sample. Because the data suggests that bio-accumulation of contaminants in the dredged material may, in some cases exceed that in the reference material the eight factors in Section 6.3 of the Green Book have been addressed below:

1. The number of species in which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference material.

There were two species tested in this evaluation, *Nereis virens* and *Macoma nasuta.* A table showing the results is provided in item 3 below. Both species showed some stations with absolute concentrations of metals in tissues above reference and control sediment.

2. The number of contaminants for which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference.

Zinc and PCBs were found to be significantly higher in *M. nasuta*, pesticides and PAHs were found to be significantly higher in *N. virens* than levels found in the reference sample.

3. Magnitude by which the bioaccumulation from the dredged material exceeds bioaccumulation from the reference material.

The source is table 24 and 26 of referenced 2010 report. The data has been rewritten and provided in percentage amounts over reference on Table 1 below.

4. Toxicological importance of the contaminants whose bioaccumulation from the dredged material statistically exceeds bioaccumulation from the reference.

a. Zinc (Zn). Zn was detected at levels above detection at in zone 2 for *M. nasuta*. The concentration of 9.4 mg/kg (wet wt.) is above the reference station values of 8.5 mg/kg (wet wt.). These are low compared to values (12 to 2900 mg/kg with one outlier of 0.06 mg/kg) listed in the literature data summarized in the WES Environmental Residue-Effects Database (ERED at http://el.erdc.usace.army.mil/ered/Index.cfm). There is no FDA level of concern established.

b. Total PCBs. PCBs were detected at levels above detection in zone 3 for *M. nasuta*. The concentration of 7.1 µg/kg (wet wt.) is above the reference station values of 6.5 µg/kg (wet wt.). These are low compared to values (1.7 mg/kg) listed in the literature data summarized in the WES Environmental Residue-Effects Database (ERED at http://el.erdc.usace.army.mil/ered/Index.cfm). This value is well below the FDA level of concern of 2.0 mg/kg.

c. Total Pesticides (4,4 DDD, 4,4' DDE, 4,4' DDT). Total pesticides were detected at levels above detection in zone 3 and zone 4 duplicate for *N. virens*. The concentrations of 7.2 and 7.3 µg/kg (wet wt.) are above the reference station values of 5.2 µg/kg (wet wt.). These are low compared to values (0.09 to 10,000 mg/kg) listed in the literature data summarized in the WES Environmental Residue-Effects Database (ERED at http://el.erdc.usace.army.mil/ered/Index.cfm). This value is well below the FDA level of concern of 5.0 mg/kg.

d. Total PAHs. Total pesticides were detected at levels above detection in zone 4 duplicate for *N. virens*. The concentration of 199 µg/kg (wet wt.) is above the reference station values of 186 ug/kg (wet wt.). These are low compared to values (0.065 to 49.3 mg/kg) listed in the literature data summarized in the WES Environmental Residue-Effects Database (ERED at http://el.erdc.usace.army.mil/ered/Index.cfm). There is no FDA level of concern established.

5. Phylogenetic diversity of the species in which bioaccumulation for the dredged material statistically exceeds bioaccumulation from the reference material.

The species tested were *Macoma nasuta* and *Nereis virens*. These species were recommended in the original 1991 "Evaluation of Dredged Material Proposed for Ocean Disposal" page 12-4, Table 12-1; labeled "Examples of Appropriate Test Species for Determining Potential Bioaccumulation From Whole Sediment Tests". The basic recommendations include requirements that a burrowing polychaete and a deposit feeding bivalve mollusk be tested. The test organisms are important in the region ecologically, represent species that provide adequate biomass for analysis, and are detritus feeders, which ingest sediments.

6. Propensity for the contaminants with statistically significant bioaccumulation to bio-magnify within the aquatic food webs.

See Table 1. PCBs and DDT found in tissues higher than reference are contaminants that have been shown to significantly bio-magnify in the food chain. Neither was found at levels high enough to consider a significant environmental hazard and are well below the levels in tables 2 and 3.

Table 1. Macoma and Nereis Tissue Comparison of Wet and Dry Weight Means for Statistically Significant Results*

	Zinc							
Macoma nasuta	Wet Wt. ng/kg (ppm)		Q	% of RS	Dry Wt. ng/kg (ppm)		Q	% of RS
RS-MP09	8.5			N/A	9.5			N/A
E-MP09-2	**9.4**	*		111%	**10.6**	*		112%

	PCBs **							
Macoma nasuta	Wet Wt. ug/kg (ppb)		Q	% of RS	Dry Wt. ug/kg (ppb)		Q	% of RS
RS-MP09	6.5			N/A	7.20			N/A
E-MP09-3	**7.1**	*		109%	**7.89**	*		110%

	Pesticides ***							
Nereis virens	Wet Wt. ug/kg (ppb)		Q	% of RS	Dry Wt. ug/kg (ppb)		Q	% of RS
RS-MP09	5.2		J, T	N/A	6.0		J, T	N/A
E-MP09-3	**7.2**	*	J, N, T	#REF!	**8.5**	*	J, N, T	142%
E-MP09-5 (Field Dup of Zone 4)	**7.3**	*	J, N, T	#REF!	**8.7**	*	J, N, T	145%

	PAHs †							
Nereis virens	Wet Wt. ug/kg (ppb)		Q	% of RS	Dry Wt. ug/kg (ppb)		Q	% of RS
RS-MP09	186		ND	N/A	214		ND	N/A
E-MP09-5 (Field Dup of Zone 4)	**199**	*		107%	**237**	*		111%

All results are given as the mean of 5 replicates.

* Statistically significant compared to the Reference (value is also shown in bolded text)

** **PCB Congeners:** 8, 18, 28, 44, 49, 52, 66, 77, 87, 101, 105, 118, 126, 128, 138, 153, 156, 169, 170, 180, 183, 184, 187, 195, 206, 209

***Pesticides:** 4,4-DDD, 4,4'-DDE, 4,4'-DDT

† **PAHs**: Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[g,h,i]perylene, Benzo[b]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 1-methylnaphthalene, Benzo[k]fluoranthene, 2-methylnaphthalene, Naphthalene, Phenathrene, Pyrene

7. Magnitude of toxicity and the number and phylogenetic diversity of species exhibiting greater mortality in the dredged material than in the reference material.

Phylogenetic diversity of species is discussed in the response to 5 above. All species selected for testing were selected based in part on their phylogenetic diversity.

Data for the survival of *M. nasuta* and *N. virens* in the bio-accumulation tests are presented in Table 14 of the 2010 Report. *M. nasuta* survivorship in the laboratory control sediment was 95 percent. Survival of *M. nasuta* in the site sediments ranged from 87 percent (sample zone 3) to 96 percent (sample zone 2).

N. virens survivorship in the laboratory control sediment was 97 percent. Survival of *N. virens* in the site sediments ranged from 94 percent (sample zone 1) to 100 percent (sample zones 2 and 3).

Mortality results in the 28-day bioaccumulation phase are not comparable to results in the 10-day bioassay procedure, and are for information purposes only, and are not used for tier three evaluation purposes.

8. Magnitude by which contaminates whose bio-accumulation from the dredged material exceeds that from the reference material also exceed the concentrations found in comparable species living in the vicinity of the proposed disposal site.

Exact comparative values for animals in the NOAA "Mussel Watch" program (source: National Oceanic and Atmospheric Administration (NOAA), 1998 (on-line); "Chemical Contaminants in Oysters and Mussels" by Tom O'Connor; NOAA's State of the Coast Report, Silver Spring, MD: NOAA. URL: http://state_of_coast.noaa.gov/bulletins/html/ccom_05/ccom.html) in the vicinity of the project site were not immediately available.

Overall nationwide trends in the above referenced study are provided on the attached tables. Table 2 below provides a comparison of dry wt. concentrations. The values for each of the analytes that showed statistically significant exceedance of the reference values were as follows for *M. nasuta* dry wt.; Zn at 10.6 ppm and total PCBs at 7.89 ppb. For *N. virens* dry wt.; total pesticides at 8.7 ppb and total PAHs at 237 ppb. These values compare favorably with median concentrations reported in Table 2 below.

Based on comparisons with FDA Action Levels and consideration of the factors above, the data indicate no significant potential for bio-accumulation from the dredged material. Consequently, it is determined that there is no potential for undesirable effects due to bio-accumulation as a result of the presence of individual chemicals or of the solid phase of the dredged material as a whole. Therefore, it is concluded that the solid phase of the material proposed for disposal meets the ocean disposal criteria at 40 CFR §227.6(c)(3) and §227.27(b). The specific test results and technical analysis of the data underlying this conclusion are described and evaluated in the referenced Final Report.

TABLE 2

Annual median concentrations and spearman correlation coefficient for concentration with year

chem/Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	rs (conc v yr)
As	9.67	9.03	8.80	8.22	9.11	9.10	9.18	8.30	8.96	10.14	0.103
Cd	3.20	2.83	2.86	2.63	2.80	2.45	2.15	2.57	2.25	2.30	-0.867
Hg	0.11	0.10	0.11	0.12	0.09	0.11	0.10	0.11	0.10	0.11	-0.271
Ni	2.13	1.93	1.80	1.73	1.67	2.07	2.19	1.66	1.50	2.03	-0.273
Se	2.57	2.60	2.93	2.28	2.44	2.57	2.58	2.48	2.61	3.28	0.267
Cu(mus)	9.80	9.97	9.73	9.93	8.60	8.83	8.67	8.22	8.69	8.76	-0.685
Cu(oys)	103	118	139	118	139	120	130	118	98	134	0.068
Pb(mus)	2.32	1.83	2.05	1.63	1.63	2.00	1.55	1.70	2.03	1.83	-0.345
Pb(oys)	0.41	0.46	0.47	0.46	0.52	0.56	0.46	0.52	0.67	0.45	0.426
Zn(mus)	143	133	128	120	133	128	120	120	120	120	-0.837
Zn(oys)	1633	1758	2300	2246	2383	1996	2089	2100	2047	2038	0.152
Σcdane	14.69	19.29	14.18	13.72	13.16	5.59	6.02	6.96	6.24	5.37	-0.879
Σddt	37.07	41.13	37.63	35.53	30.11	18.38	24.40	23.80	26.10	23.63	-0.806
Σdield	6.07	8.30	4.50	4.20	3.28	3.01	3.61	3.61	2.82	2.70	-0.888
Σpcb	145	121	137	118	110	58	70	62	92	74	-0.770
Σpah			506	273	248	215	237	232	229	191	-0.857
Σbt				106.12	71.09	64.25	47.36	15.52	22.59	14.57	-0.964

(back to Appendices)

Field Name	Definition/Description
AS	Arsenic (µg/g or ppm dryweight)
CD	Cadium (µg/g or ppm dryweight)
HG	Mercury (µg/g or ppm dryweight)
NI	Nickel (µg/g or ppm dryweight)
SE	Selenium (µg/g or ppm dryweight)
CU	Copper (µg/g or ppm dryweight) (mu-mussels; oys-oysters)
PB	Lead (µg/g or ppm dryweight) (mu-mussels; oys-oysters)
ZN	Zinc (µg/g or ppm dryweight) (mu-mussels; oys-oysters)
Σcdane	Total chlordane (ng/g or ppb)
Σddt	Total DDT (ng/g or ppb)
Σdield	Total dieldrin (ng/g or ppb)
Σpcb	Total polychlorinated biphenyl (ng/g or ppb)
Σpah	Total polycyclic aromatic hydrocarbons (ng/g or ppb)
Σbt	Total butyl tin (ng/g or ppb as SN)

Table 3. Concentrations defining the high end of the overall distribution of concentrations measured in mollusks by the Mussel Watch Project.

Chemical	High concentration	Chemical	High concentration
ΣDDT	140 ppb-dry	mercury (Hg)	0.23 ppm-dry
ΣPCB	430	nickel (Ni)	3.3
ΣChlordane	34	selenium (Se)	3.5
ΣDieldrin	9.1	cadmium (Cd)	6.2
ΣPAH	1100	arsenic (As)	17
ΣBT	300 ppb(as Sn)	copper (Cu)[1]	12 (mussels) 370 (oysters)
		zinc (Zn)[1]	200 (mu) 5100 (oy)
		lead (Pb)[1]	4.8 (mu) 0.84 (oy)

[1]High concentrations for copper, zinc and lead must be calculated separately for mussels and oysters.

5.0 MPRSA Section 103 Ocean Disposal Criteria Compliance Evaluation

5.1 Compliance with Part 227 Subpart B-Environmental Impact

5.1.1. §227.4 Criteria for Evaluation Environmental Impact

The applicable prohibitions, limits, and conditions set forth in 227.4 have been satisfied as described in Sections 3 and 4.

5.1.2 §227.5 Prohibited Materials

The material to be dumped is dredged material that has been evaluated and found to meet the criteria of the ocean dumping regulations. The material approved for disposal is not:

- high level radioactive waste;
- material used for radiological, chemical, or biological warfare;
- materials whose composition and properties have been insufficiently described to enable application of 40 CFR Part 227, Subpart B;
- inert synthetic or natural materials which may float or remain in suspension so as to materially interfere with fishing, navigation, or other use of the ocean;
- medical waste as prohibited by §102(a) of MPRSA.

5.1.3 §227.6 Constituents Prohibited as Other Than Trace Contaminants

The material to be dumped has been evaluated and found that the constituents listed in this section are not present in other than trace amounts. See Sections 3 and 4.

5.1.4 §227.9 Limitations on Quantities of Waste Materials

Section 227.9 provides that substances that may cause damage to the ocean environment due to the quantities in which they are dumped or seriously reduce amenities may be dumped only when the quantities to be dumped at a single time and place are controlled to prevent long-term damage to the environment or amenities. The proposed dredged material would not result in long-term damage to amenities or the environment due to the quantities in which it would be dumped. The material would be disposed of at the Jacksonville and Fernandina Beach ODMDS. These sites were given final designation by EPA (40 CFR 228.15(h)(9) and 40 CFR 228.15(h)(8) respectively) following preparation of an EIS and determination that they met the environmentally based site selection criteria of 40 CFR Part 228, including those related to amenities (see §228.6(a)(2), (3), (8), and (11)). The proposed dredged material has been tested and found to meet the requirements of 40 CFR 227.6 and 227.27, as described in Sections 3 and 4 of this evaluation. In addition, disposal operations will be managed to assure dumping takes place within the site boundaries. It is concluded that the proposed disposal would not cause long-term damage to amenities or the environment due to the quantities in which it would be dumped. The current project is estimated to be approximately 5,150,000 cubic yards and the shoaling is estimated to be 1,090,000 cy since the last surveys were completed after the January 2009 maintenance dredging event.

Please refer to the DRAFT USACE STFATE ADDAMS Modeling Report in Tab 3 where the capacity of the Jacksonville ODMDS is discussed in Appendix B based on the MDFATE Final Report data. Also, please see the Final EIS for the Proposed Homeporting of Additional Ships at Naval Station Mayport, Fla, where Appendix A.2, ASA report dated August 2007, discusses the "Calculation of Existing Capacity at the Jacksonville and Fernandina Beach Ocean Dredged Material Dredged Sites." According to these documents, DM quantities can be accommodated by the use of both sites. The Fernandina Beach ODMDS has an estimated 58 million cy of capacity remaining; however, the Jacksonville ODMDS has only 2.5 million cy of capacity and is limited to take on 2 million cy of new work from this project. Disposal release zones in the Northwest corner and Southeast corner at alternate tides will help to evenly disperse the material to fully utilize the Jacksonville ODMDS remaining capacity and keep material within the site.

5.1.5 §227.10 Hazards to Fishing, Navigation, Shorelines, or Beaches

Section 227.10 provides that with regard to the disposal of dredged material, the site and conditions must be such that there is no unacceptable interference with fishing or navigation and no unacceptable danger to shorelines or beaches resulting from dredged material disposal. The project material proposed for dumping would not interfere with fishing, navigation, or pose unacceptable danger to shorelines or beaches. The EISs for the Jacksonville and Fernandina Beach ODMDS designation and information previously outlined in this report fully support compliance of the project material within this section.

5.1.6 §227.13 Dredged Materials

The material to be dumped does not meet the criteria of paragraph (b) of this section and therefore further testing was required. As discussed in Sections 3 and 4 of this report, the material was found to be environmentally acceptable for ocean dumping.

5.2 Compliance with Part 227, Subpart C - Need for Ocean Dumping

The Department of the Navy has summarized the need for Ocean Disposal options in the *Record of Decision in the Homeporting of Additional Ships at Naval Station Mayport, Florida*, (ROD). Since 315,000 cy of material from the Destroyer Basin has not met the criteria for ocean disposal, upland capacity is reserved for such sediments. Additionally, since NS Mayport has an established record of compliance with USEPA criteria for ocean disposal, it is reasonable to propose that DM be placed in the ODMDS for the accommodation of future additional ships.

5.3 Compliance with Part 227, Subpart D - Impact of the Proposed Dumping on Aesthetic, Recreational and Economic Values

40 CFR Section 227, Subpart D sets forth the factors to be considered when evaluating the impact of proposed dumping on aesthetic, recreational, and economic values, including the potential for affecting recreational and commercial uses and values of living marine resources.

The factors specifically considered include recreation and commercial uses, water quality, the nature and extent of disposal operations, visible characteristics of the material to be disposed, presence of pathogens, toxic chemicals, bioaccumulation potential, or any other constituent which can affect living marine resources of recreational or commercial value. These would be

used in an overall assessment of the proposed dumping on aesthetic, recreational, or economic values and possible alternative methods of disposal or recycling. See 40 CFR §227.17, §227.18, and §227.19.

The Environmental Impact Statements (EIS) for the Jacksonville and Fernandina Beach ODMDS designations discusses the potential impacts of disposal at the site on recreational fisheries, commercial fisheries, shore recreation, and cultural resources with regard to disposal of dredged material at the sites. The only items above that need be specifically addressed in this document are the visible characteristics of the material and the presence of pathogens. Section 227.7(c) contains a more detailed discussion of pathogens and dredged material. The material from this project, as is typical of dredged material, is composed of wet sediments, which have accumulated on the bottom of water bodies and when ocean disposed, quickly sink to the bottom, leaving no visible plume a short time after disposal. There are no known sources of potential pathogens that could have specifically impacted the project sediments. On the basis of the discussion in the EIS and the findings of this report, it is not expected that adverse impacts to the above amenities would occur.

With respect to Section 227.17(b)(2), if the dumping were not authorized there would be an adverse impact on national defense, as the aircraft carriers and associated support ships operating from Mayport NS require deep channels. Failure to dredge this project would not adversely impact recreational boating or aesthetic values.

Compliance with Part 227, Subpart E - Impact of the Proposed Dumping on Other Uses of the Ocean

40 CFR Section 227, Subpart E sets forth the factors to be considered in evaluating the impacts of the proposed dumping on other uses of the ocean, including long-range impacts on other uses of the ocean. Specifically, the uses considered include, but are not limited to, commercial and recreational fishing in open ocean areas, coastal areas, and estuarine areas; recreation and commercial navigation; actual or anticipated exploitation of living and non-living marine resources; and scientific research and study. An overall assessment of the proposed dumping on the temporary and long-range effects of other uses of the ocean would include irreversible or irretrievable commitment of resources that would result from the proposed dumping.

The Jacksonville and Fernandina Beach ODMDS EISs address the effects of disposal on public health and safety (including navigational hazards) and the effects on the ecosystem (biota and water column). It also addresses the environmental effects and mitigative measures that are short-term, long-term, or involve the irreversible or irretrievable commitment of resources. Based upon the discussion in the EISs and the findings in this report it is concluded that there would be no adverse impact on the uses to be considered under 40 CFR Part 227, Subpart E, incorporating considerations of long-term impacts (§227.20(a)) and an evaluation on an individual basis for effects on uses of the ocean for purposes other than ocean dumping (§227.20(b)).

6.0 MPRSA Section 103 Conditions

The MPRSA Section 103 portion of a Department of the Army permit SAJ-2002-02052 (SP-BAL), presently under consideration, will contain conditions to insure disposal in compliance with the Jacksonville and Fernandina Beach ODMDS Site Management and Monitoring Plans. The conditions are listed below:

1. Reporting Addresses: The permittee shall submit all reports, documentation and correspondence required by the conditions of this permit to the following addresses:

U. S. Army Corps of Engineers (Corps)
Regulatory Division
Special Projects and Enforcement Branch
P.O. Box 4970
Jacksonville, Florida 32232-0019
or by e-mail: CESAJ-ComplyDocs@usace.army.milCESAJ-ComplyDocs@usace.army.mil

U. S. Environmental Protection Agency (EPA)
Wetlands, Coastal and Watersheds Branch
61 Forsyth Street
Atlanta, GA 30303
or by email: Mcarthur.Christopher@epamail.epa.gov

The Permittee shall reference this permit number SAJ-2002-02052(SP-BAL), on all submittals. Email submittals shall include the project name and permit number on the subject line.

2. Commencement & Completion Notification: The Permittee shall provide the Corps and EPA written notification of the date of commencement of work authorized by this permit at least 15 days before initiation of any dredging operations authorized by this permit and a completion notification no less than 15 days after the completion of the dredging operation.

3. EPA Concurrency: The Permittee shall not transport dredged material to the Fernandina Beach or the Jacksonville ODMDS until concurrency is granted from the U.S. Environmental Protection Agency to ensure the proposed dredge material meets the Ocean Disposal Criteria (40 CFR 227).

4. Manatee Standard Conditions: The Permittee shall comply with the "Standard Manatee Conditions for In-Water Work - 2009" attached to this permit.

5. Manatee Nighttime Condition for Clamshell Dredging: To reduce the possibility of injuring or killing a manatee during construction, night-time clamshell dredging shall only be perform within the Mayport Turning Basin from the last full week in October through February 28. Dredge mobilization and demobilization may occur prior to and after this window. The window may be extended up to an additional 21 days in the event the dredging is not completed within the specified window. The Permittee shall notify the U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office (JAFL), in writing of the need for the extension and request for approval along with supporting information, at least two weeks prior to the beginning of the requested extension. The JAFL shall provide its written response, indicating

either concurrence, non-concurrence, or concurrence with additional conditions, to the Navy within two days of receipt of the request.

6. Biological Opinion: This Corps permit does not authorize the Permittee to take an endangered species, in particular the smalltooth sawfish, shortnose sturgeon, North Atlantic right whales and humpback whales, loggerhead sea turtle, green sea turtle, and Kemp's ridley sea turtle. In order to legally take a listed species, the Permittee must have separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit, or a BO under ESA Section 7, with "incidental take" provisions with which the Permittee must comply). The enclosed National Marine Fisheries Service (NMFS) Biological Opinion (BO) contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that is also specified in the BO. Authorization under this Corps permit is conditional upon compliance with all of the mandatory terms and conditions associated with incidental take of the attached BO, which terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute non-compliance with this Corps permit. The NMFS is the appropriate authority to determine compliance with the terms and conditions of its BO, and with the ESA.

7. Dredging Depth Tolerance: The Permittee shall not exceed a depth of -59 feet MLLW.

8. Jacksonville ODMDS Dredge Material Limitation: The Permittee shall ensure that no more than 2 million cubic yards of new deepening *in situ* dredge material shall be disposed in the Jacksonville ODMDS.

9. Jacksonville ODMDS Mid-Project Survey: The Permittee shall conduct a bathymetric survey of the Jacksonville ODMDS when between 800,000 cubic yards and 1 million cy of in situ material has been disposed of in the ODMDS. The survey transects shall be spaced at 500-foot intervals or less. Vertical accuracy of the survey shall be +/-0.5 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either microwave line of site system or differential global positioning system. The vertical datum shall be MLLW and the horizontal datum shall use Florida State Plane or latitude and longitude coordinates (North American Datum 1983). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as decimal degrees to 6 decimal points.

10. Loss of Material: The Permittee shall not allow water or dredged material placed in a hopper dredge or scow to flow over the sides or leak from such vessels during transportation to the Jacksonville or Fernandina Beach ODMDSs.

11. Mayport Turning Basin Buffer: When using a "hopper" or "cutter-suction and barge" in the Mayport Turning Basin, the following provisions apply:

When dredging east of Station 9+65, a 25-foot buffer is allowed. If any portion of DM is taken west of 9+90, the following restrictions to load size apply for DM transported to either the Jacksonville or Fernandina Beach ODMDS. This buffer will ensure that when the western portion of the Turning Basin is dredged, the DM goes to the following release zone only. The buffer line is depicted on the attached Mayport Turning Basin drawing.

12. Jacksonville ODMDS Disposal Release Zone Restrictions:

The Permittee shall prescribe to the following Coordinates and Conditions for the Release Zones within the Jacksonville ODMDS:

1,500 x 4,000 Northeast Release Zone				
	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 21 25.92997	-81 18 27.56902	2,189,967	559,132
NE	30 21 25.89005	-81 18 27.70587	2,189,963	563,120
SW	30 21 11.04240	-81 18 27.62516	2,188,463	559,123
SE	30 21 11.06847	-81 17 41.95932	2,188,455	563,124

In the 1,500 x 4,000 Release Zone:

- The dredge area Turning Basin (MTB), Entrance Channel (MEC), and Bar Cut 3 (BC3) that use the dredge plant "clamshell and barge" shall have a maximum allowable load limit of 6,000 cy when the tide is directed south.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 9,000 cy when the tide is directed south.
- The dredge area Station 0+00 – 9+65 that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 9,500 cy when the tide is directed south.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "cutter-suction and barge" shall have a maximum allowable load limit of 6,000 cy when the tide is directed south.

1,500 x 4,000 Southeast Release Zone				
	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 20 50.69682	-81 18 16.66213	2,186,405	560,078
NE	30 20 50.60776	-81 18 16.65044	2,186,396	564,079
SW	30 20 35.84888	-81 18 16.69603	2,184,905	560,071
SE	30 20 35.86403	-81 17 31.00045	2,184,896	564,075

In the 1,500 x 4,000 Release Zone:

- The dredge area MTB, MEC, and BC3 that shall use the dredge plant "clamshell and barge" shall have a maximum allowable load limit of 6,000 cy when the tide is directed north.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 9,000 cy when the tide is directed north.
- The dredge area Station 0+00 – 9+65 that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 9,500 cy when the tide is directed north.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "cutter-suction and barge" shall have a maximum allowable load limit of 6,000 cy when the tide is directed north.

500 x 3,000 Northeast Release Zone				
	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 21 25.92997	-81 18 27.56902	2,189,967	559,132
NE	30 21 26.00913	-81 17 53.40684	2,189,967	562,125
SW	30 21 20.98073	-81 18 27.55354	2,189,467	559,132
SE	30 21 21.05988	-81 17 53.39183	2,189,467	562,125

In the 500 x 3,000 Release Zone:

- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 5,500 cy when the tide is directed south.
- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "cutter-suction and barge" will have a maximum allowable load limit of 5,000 cy when the tide is directed south.

500 x 3,000 Southeast Release Zone				
	Geographic (NAD83)		State Plane (Fl East NAD83)	
	Latitude	Longitude	Y-Northing	X-Easting
NW	30 20 40.77499	-81 18 05.34429	2,185,400	561,067
NE	30 20 40.75388	-81 17 31.02637	2,185,390	564,074
SW	30 20 35.85543	-81 18 05.32921	2,184,903	561,067
SE	30 20 35.86403	-81 17 31.00045	2,184,896	564,075

In the 500 x 3,000 Release Zone:

- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 5,500 cy when the tide is directed north.
- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "cutter-suction and barge" shall have a maximum allowable load limit of 5,000 cy when the tide is directed north.

The Permittee shall ensure the hopper dredge or scow shall be in the closed position and all discharge of material has ceased before the disposal vessel leaves the ODMDS.

13. Fernandina Beach ODMDS Disposal Release Zone Restrictions:

The Permittee shall ensure that the disposal of material in the Fernandina Beach ODMDS shall occur no less than 1,500 feet inside the site boundaries within the ODMDS defined by the following coordinates:

	Geographic (NAD83)		**State Plane (FL East 0901 Ft NAD83)**	
NW Corner	30E32.7670'N	81E18.8359'W	2258679 N	557344 E
NE Corner	30E32.7670'N	81E17.1409'W	2258656 N	566237 E
SW Corner	30E31.2619'N	81E18.8359'W	2249556 N	557319 E
SE Corner	30E31.2619'N	81E17.1408'W	2249532 N	566214 E

The Permittee shall ensure the hopper dredge or scow shall be in the closed position and all discharge of material has ceased before the disposal vessel leaves the ODMDS.

DM placed in the Fernandina Beach ODMDS shall have the following load limit restrictions:

- All dredge areas (MTB, MEC, and BC3) that shall use the dredge plant "clamshell and barge" shall have a maximum allowable load limit of 6000 cy.
- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 5,500 cy.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "hopper dredge" shall have a maximum allowable load limit of 11,500 cy.
- The dredge area west of Station 9+65 in MTB that shall use the dredge plant "cutter-suction and barge" shall have a maximum allowable load limit of 5,000 cy.
- The dredge area east of Station 9+65 in MTB, MEC, and BC3 that shall use the dredge plant "cutter-suction and barge" shall have a maximum allowable load limit of 6,000 cy.

14. Disposal Operations Compliance: The Permittee shall ensure that the dredge material is released in either the Fernandina Beach or Jacksonville ODMDS release zone. If a violation occurs: a) the violation shall be reported to the contracting officer's representative immediately at (904) 232-2086 or (904) 607-5847 and to EPA's Ocean Dumping Coordinator immediately at

(404) 562-9391. b) written notification shall by faxed to EPA Region 4, Attn: EPA's Ocean Dumping Coordinator at (404) 562-9343, to U.S. Army Corps of Engineers, Operations at (904) 232-2143 and U.S. Army Corps of Engineers, Enforcement Section at (904) 232-1904 within twenty-four (24) hours after the violation occurs. A Compliance Report shall be submitted within three working days after a violation is reported.

15. Compliance Report (if needed): The Permittee shall submit a report on any disposal of dredge material outside the release zones of the Fernandina Beach or Jacksonville ODMDS sites. The report shall be submitted within three working days after the incident. The report shall include the location of the loss material and the amount of material placed outside the authorized ODMDS release zone. The report shall include a narrative with a description of the violation, indicate the time it occurred and when it was reported to the EPA and the Corps, discuss the circumstances surrounding the violation, and identify specific measures taken to prevent reoccurrence.

16. Silent Inspector: The Permittee shall use the Silent Inspector (SI) to monitor dredging and dredge material disposal. The Permittee shall have a SI certification by the SI Support Center within one calendar year prior to the initiation of the dredging/disposal. The certification shall be maintained yearly for the duration of the work. Questions regarding certification should be addressed to the SI Support Center at 877-840-8024. Additional information about the SI System can be found at http://si.usace.army. The Permittee is responsible for insuring that the SI system is operational throughout the dredging and disposal project and that project data are submitted to the SI National Support Center in accordance with the specifications provided at the aforementioned website. The data collected by the SI system shall, upon request, be made available to the Corps.

17. Electronic Tracking System: The Permittee shall continuously track the horizontal location and draft condition of the disposal vessel (hopper dredge or scow) to and from the Jacksonville ODMDS and Fernandina Beach ODMDSs. Data shall be collected at least every 500 feet during travel to and from the ODMDS and every minute or every 200 feet of travel, whichever is lesser, while approaching within 1,000 feet of and within the ODMDS. The Permittee shall use Florida State Plane or latitude and longitude coordinates (North American Datum 1983). State Plane coordinates shall be reported to the nearest foot and latitude and longitude coordinates shall be reported as decimal degrees out to 6 decimals. Westerly longitudes are to be reported as negative. Draft readings shall be recorded in feet out to 2 decimals. If the electronic positioning system fails or navigation problems are detected, all disposal operations shall cease until the failure or navigation problems are corrected.

18. Load Data: The Permittee shall record electronically for each load the following information:

a. Load Number
b. Disposal Vessel or Scow Name
c. Tow Vessel Name (if scow used)
d. Captain of Disposal or Tow Vessel
e. Name of the Disposal Site
f. Estimated volume of Load
g. Description of Material Disposed
h. Source of Dredged Material/Acceptance Section
i. Date, Time and Location at Initiation and Completion of Disposal Event
j. The ETS data required by the Electronic Tracking System Special Condition.

19. Bathymetric Survey: The Permittee shall conduct a bathymetric survey of the Jacksonville ODMDS and Fernandina ODMDS within 90 days prior to project disposal and within 45 days following project completion in accordance with the following:

a. The number and length of the survey transects shall be sufficient to encompass the Jacksonville ODMDS and Fernandina ODMDS and a 500 foot wide area around the site. The transects shall be spaced at 500-foot intervals or less.

b. Vertical accuracy of the survey shall be +/-0.5 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either microwave line of site system or differential global positioning system. The vertical datum shall be mean lower low water (MLLW) and the horizontal datum shall use Florida State Plane or latitude and longitude coordinates (North American Datum 1983). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as decimal degrees to 6 decimal points.

20. Electronic Data: The Permittee shall provide electronic data required by the **Electronic Tracking System** and **Load Data** Special Conditions above to USEPA Region 4 on a weekly basis. The data shall be submitted as an eXtensible Markup Language (XML) document via Internet e-mail to DisposalData.R4@epa.gov. XML data file format specifications are available from USEPA Region 4.

21. Post-Disposal Data: The Permittee shall submit Post-Disposal Data to the Corps and USEPA at the address referenced in the Reporting Addresses Special Condition above documenting compliance with all general and special conditions defined in this permit. The Post-Disposal Data shall be sent within 90 days after completion of the disposal operations authorized by this permit. The Post-Disposal Data shall consist of four individual reports, which are: Summary Report, Material Discharge Report, Summary Scatter Plot, and Bathymetric Survey Results. The reports shall include, at a minimum, the following information:

a. The **Summary Report** shall include: dredging project title; DOA permit number and expiration date (if applicable), contract number, name of contractor, name and type of vessel(s) discharging material in ODMDS, disposal timeframes for each vessel, total volume (paid and unpaid in situ dredged quantity) for contract, total volume (paid and unpaid in situ dredged quantity) to each disposal location, total paid volume (paid in situ dredged quantity) to ODMDS, gross volume (reported by contractor) to ODMDS, number of loads to ODMDS, type of material to ODMDS, number of loads placed outside authorized ODMDS release zone, number of loads placed outside ODMDS limits, dates of pre-disposal and post-disposal bathymetric surveys, and a brief narrative discussing any violation(s) of the 103 concurrency and/or DOA permit (if applicable). This narrative shall include a description of the violation, indicate the time it occurred and when it was reported to the EPA, discuss the circumstances surrounding the violation, and identify specific measures taken to prevent reoccurrence.

b. The **Material Discharge Report** shall include a spreadsheet of all material discharges in the Jacksonville ODMDS and Fernandina ODMDS, in Microsoft Excel format with the load number; disposal vessel name and type, tow vessel name (if applicable), Captain of disposal or tow vessel, estimated volume of load, description of material, source of material, date,

time, and exact coordinate location at which discharge was initiated. The coordinate system and horizontal datum should be provided in State Plane Coordinates Florida East (NAD 83) to identify the discharge locations on the report.

c. **Summary Scatter Plot(s)** shall include a summary scatter plot(s), in Adobe Acrobat PDF format for all material discharges in the Jacksonville ODMDS and Fernandina ODMDS which clearly indicates the authorized release zone, ODMDS limits, and exact location at which discharge was initiated. Each discharge will be labeled with the corresponding load number at a small but legible font. No more than fifty discharges may be shown on any individual plot.

d. The **Bathymetric Survey Results** shall include pre-disposal and post-disposal bathymetric survey plots in Adobe Acrobat PDF format. Field data used to create the soundings shown on these survey plots will be provided in sorted and space-delimited ASCII files. The plots will indicate the state plane coordinate system, horizontal datum, and vertical datum on which the surveys are based.

22. Navigation Assurance: The Permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structures or work herein authorized, or if in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the Permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

7.0 Determination

a. The proposed action is not expected to significantly degrade or endanger human health, welfare or amenities, or the marine environment, ecological systems or economic potentialities.

b. There is very limited upland disposal capacity available that is economically or environmentally feasible. For the bulk of the material from this project there is no alternative disposal site other than the ocean disposal sites.

c. All samples within the proposed construction were found to be acceptable for ocean disposal.

8.0 Findings

The proposed action is in compliance with the requirements of 40 CFR Parts 220-227, and may be implemented.

PREPARED BY:

Glenn Schuster, P.E.
District Ocean Disposal Coordinator

Literature Cited

Kennedy, A.J., Hendrix, S.H., and Coleman J.G. June 2010. "ERDC Draft Literature Review: Ammonia Toxicity to Regionally Important Elutriate Toxicity Test Species." U.S. Army Engineer Research and Development Center, Environmental Laboratory.

Environmental Protection Agency (EPA). 1994. National Primary Drinking Water Standards. February. EPA 810-F-94-001A.

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NAS/NAE. 1973. *Water Quality Criteria 1972* (Blue Book). A Report of the Committee on Water Quality Criteria. National Academy of Science and National Academy of Engineers, Washington, DC. NTIS-PB 236199. USGPO #5501-00520.

USEPA/USACE. 2008. *Southeast Regional Implementation Manual (SERIM) for Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.* EPA 904-B-08-001. U.S. Environmental Protection Agency Region 4 and U.S. Army Corps of Engineers, South Atlantic Division, Atlanta, GA.

Aqua Survey, Inc.

VOLUME I

Mayport Naval Station Section 103 Sediment Characterization

Technical Report on the Sampling and Testing of Material from the Mayport Naval Station Basin, Jacksonville, Florida, Proposed for Dredging and Ocean Disposal

Prepared for

United States Army Corps of Engineers
Jacksonville District
701 San Marco Blvd.
CESAJ-CT
Jacksonville, FL 32207-8175

June 17, 2010

ASI Job # 30-003

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Signature Page

Mayport Naval Station Section 103 Sediment Characterization

Prepared for

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Jacksonville, FL 32207-8175

This report, as well as all records and raw data were audited and found to be an accurate reflection of the study. Copies of raw data will be maintained by Aqua Survey, Inc, 469 Point Breeze Road, Flemington, New Jersey, 08822.

Robert M. Fristrom — 6/17/10
Robert M. Fristrom — Date
Quality Assurance Officer

Michelle Thomas — 6/17/10
Michelle Thomas — Date
Laboratory Manager

Jon Doi — 6-17-10
Jon Doi, Ph.D — Date
Executive Vice President

Summary Page

Mayport Naval Station Section 103 Sediment Characterization

Technical Report on the Sampling and Testing of Material from the Mayport Naval Station Basin, Jacksonville, Florida, Proposed for Dredging and Ocean Disposal

Study Initiation Date

January 8, 2010

Study Completion Date

June 17, 2010

Performing Laboratory

Aqua Survey, Inc.
469 Point Breeze Road
Flemington, New Jersey 08822

Sponsor

United States Army Corps of Engineers
Jacksonville District
701 San Marco Blvd.
CESAJ-CT
Jacksonville, FL 32207-8175

Laboratory Project ID

30-003

I. EXECUTIVE SUMMARY

A Mayport Naval Station Basin Section 103 Sediment Characterization was undertaken by Aqua Survey, Inc. The original sampling event took place in January 2010. Four zones in the Mayport Naval Station (NS) Basin were sampled and five cells in each zone were subsampled. The five cells in each zone were composited together to form the four zone composite sediment samples. A Field Duplicate was taken at Zone 4. A site water sample was taken at the center of the Mayport NS Basin. Two reference samples were taken offshore within the Jacksonville Ocean Dredged Material Disposal Site (ODMDS) and were composited together to form the reference composite sediment sample.

All biological and chemical testing took place using the four zone composite samples, the Field Duplicate sample of Zone 4 and the Mayport NS Basin site water used to prepare the chemical and biological elutriate samples. Although it appeared at first like copper was extremely high, it turned out to be an analytical interferent. Arsenic did appear to be relatively high. Both the 10-day *L. plumulosus* and *A. bahia* Solid Phase tests passed the survival criteria for ocean disposal. The *M. nasuta* and *N. virens* bioaccumulation tests showed tissue analytes that were statistically different from the equivalent reference analytes. Specifically, for the Macoma clam, Zinc in Zone 2 and Total PCBs in Zone 3, and for the Nereis worm, 4,4'-DDD in Zone 1, Zone 3 and the Field Duplicate of Zone 4, Phenanthrene for Field Duplicate of Zone 4 and Total PAHs in the Field Duplicate of Zone 4 for the Nereis worms were statistically different from the reference. No analytes in either the clam or worm tissue samples were above the FDA action levels.

The most interesting aspect of the project dealt with the Suspended Particulate Phase (SPP) results. Although the *M. edulis* development results usually drive the biological input to the ADDAMS Model as being the most sensitive endpoint of the three SPP toxicity tests, the *M. beryllina* LC_{50} results also showed high toxicity, i.e., three of the zone elutriates had LC_{50} values between 24.0 and 33.1%. It was also noted that all sediment and elutriate samples had high levels of ammonia – higher than has previously been seen for Mayport NS Basin samples in earlier Section 103 studies.

The ADDAMS Model indicated that with the dredging parameters supplied by the Jacksonville Army Corps and using the *M. edulis* development results, since this endpoint was the most sensitive of all the SPP toxicity tests, the largest allowable disposal volume was 1,500 CY and only when restricted to placement at the NW corner of the Jacksonville ODMDS.

It was decided among the Jacksonville Corps, EPA Region 4 and Aqua Survey that a second round of sampling and testing ("Retest") would take place to address the ammonia issue. This Retest sampling event took place in April 2010.

The four zones were resampled with all five cells subsampled and the Mayport NS Basin site water was also resampled.

The Retest testing scheme focused only on SPP biological testing and chemical analysis. Both chemical and biological elutriate samples were analyzed for all chemical parameters as in the original round of testing. The ammonia issue was addressed by using an EA Engineering ammonia-stripping procedure [Derrick, 2010] to remove ammonia from marine water samples. The method involved pH manipulation with base and acid to raise the pH high enough so that ammonia is primarily in the un-ionized form, aerate the water sample vigorously while sweeping the surface of the container with a fan to remove the ammonia from the surface of the water sample. Once the amount of ammonia to be removed is achieved, acid is added to the sample to bring the pH back to its original concentration. Note that two things happened when using this procedure to strip ammonia from the seawater sample. First, significantly more salinity wass added to the system. This may cause problems with the ability of the three SPP test organisms to be healthy at high salinities. Second, metals can precipitate out at high pH (as metal hydroxides or oxides). Bringing the pH back to near neutrality does not guarantee that these metal precipitates redissolve. Both of these concerns were addressed in the Retest biological testing.

Chemical analysis of both the unaltered and ammonia-stripped elutriate samples were undertaken and showed that metals were not lost through the ammonia stripping procedure. In fact, the concentration of some metals increased, which may be due to the strong acid releasing more metals into solution from the sediments than was originally the case.

Use of a salinity-adjusted Mayport NS Basin site water sample to evaluate whether salinity is a problem or not was used as a control when the zone elutriates were run through the ammonia-stripping procedure. Base and acid were added to the site water such that the salinity was equal to the salinity of the ammonia-stripped elutriate samples. Using this site water control, it was determined that both the *A. bahia* and *M. beryllina* could take salinity concentrations in the lower 40's ppt with no ill affects. However, both *M. edulis'* endpoints were significantly affected by high salinity. For this reason, a second *M. edulis* test was run with the Retest zone samples and Mayport NS Basin site water. The ammonia-stripping procedure was revised to not raise the pH as high to remove the ammonia and therefore less acid would be required to bring the pH back to the original values of the unaltered elutriate samples. Therefore, lower salinities resulted (closer to the mid 30's ppt rather than the low 40's). The salinity-adjusted site water control showed that neither the survival or development endpoint of the *M. edulis* test were affected by salinities in the mid 30's ppt. Note that an additional procedure was run and that was to dilute the ammonia-stripped samples and the salinity-adjusted site water with DI water to bring the salinity down to the 30-32 ppt range – the acceptable range in the biological testing method. Since the undiluted

samples had no salinity issues, the dilution of the samples turned out not to be necessary.

The results of the Retest SPP tests indicated that when ammonia was removed, no toxicity was observed with either the *M. beryllina* or the *M. edulis* endpoints. Therefore, all the toxicity seen in the original SPP tests for these two organisms were due to ammonia. For the *A. bahia*, although the toxicity was significantly reduced when the ammonia was removed, some of the toxicity remained. Therefore not all the toxicity of the original *A. bahia* SPP test was due to ammonia.

The original ESI chemistry data of the chemical elutriate samples and site water sample showed abnormally high levels of copper (150-170 ppb). The chemical elutriate samples also showed high levels of arsenic (greater than 70 ppb). Site water samples were sent to two other labs for confirmation of these results and they showed the typical low levels of copper that have been seen in the past, i.e., concentrations less than 1 ppb.

Since interferences occurred with the original metals analyses and it was confirmed that ESI had not performed the reductive precipitation method which separates metals in high salt matrices like seawater, it was decided that the CAS Retest chemical elutriate data would be used in the analytical summary. CAS ran the reductive precipitation method, which has been shown to give more accurate metal concentrations in seawater.

Due to the Retest SPP results, the ADDAMS Model was rerun with an Application Factor of 0.05 for both the *M. beryllina* and *M. edulis* toxicity results and an Application Factor of 0.01 for the *A. bahia* results, as this organism is the most sensitive species after ammonia toxicity is accounted for. The rerun ADDAMS Model results indicated that with the dredging parameters supplied by the Jacksonville Army Corps and using the *A. bahia* results, the largest allowable disposal volume was increased from 1,500 CY up to 6,000 CY, but it is still restricted to placement at the NW corner of the Jacksonville ODMDS.

No chemical-based ADDAMS Model had to be run, because all chemical parameters were below the EPA Water Quality Criteria in the Retest chemical elutriate samples analyzed by CAS.

II. INTRODUCTION

A. Project Overview

The objective of this study was to perform sampling, compositing, physical characterization and biological testing of sediment proposed for maintenance dredging and ocean disposal from the Mayport Naval Station Basin in Jacksonville, Florida. A total volume of 227 gallons of sediment was collected with 210 gallons used for testing (See Appendix G for specific core volumes). Testing was performed in accordance with USEPA and USACOE, 1991 Green Book, Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual, EPA-503/8-91/001; and Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters, August 2008.

Aqua Survey, Inc. (ASI) performed all sampling, biological testing and some of the physical analyses (grain size and percent moisture). MACTEC conducted the sediment settling rates, EnviroSystems (ESI) performed the chemical analyses and ANAMAR ran the ADDAMS Model on the various biological scenarios.

Whole sediment toxicity was assessed through 10-day exposures with the mysid shrimp, *Americamysis bahia*, and the amphipod, *Leptocheirus plumulosus*, in solid phase tests.

Toxicity of Suspended Particulate Phase (elutriate) samples prepared from the composite was assessed through 96-hour suspended particulate phase toxicity bioassays with the inland silverside, *Menidia beryllina* and the mysid shrimp, *Americamysis bahia.* A 48-hour embryo development test was performed using the blue mussel, *Mytilus edulis*.

Bioaccumulation of metals, pesticides (DDD, DDE, DDT), PCB congeners, pentachlorophenol, PAHs, and organotins was assessed using 28-day exposures of the clam, *Macoma nasuta* and the sand worm, *Nereis virens* to the composite sediment samples.

At the request of the Jacksonville Army Corps, ASI resampled the four zones, plus a field split of Zone 3 and the Mayport NS Basin site water. A total volume of 74 gallons of sediment was collected and used for testing (See Appendix H for specific core volumes). ASI ran a Retest of all three of the SPP acute toxicity tests. The elutriates were run in the three SPP toxicity tests as is and with the ammonia removed by pH manipulation in order to evaluate whether the acute toxicity in the SPP tests were only due to high ammonia levels. Chemistry elutriate samples were prepared and analyzed by Columbia Analytical Services (CAS). The biological elutriate

samples with and without the ammonia removed were also analyzed by CAS to determine if the pH manipulation method used to remove ammonia also may have removed metals.

B. Acronyms

ASI	Aqua Survey, Inc.
CAS	Columbia Analytical Service
CY	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyltrichloroethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	Differential Global Positioning System
DI	deionized water
DO	dissolved oxygen
EC_{50}	concentration at which 50% of the organisms are affected
ESI	EnviroSystems, Inc.
FDA	Food and Drug Administration
Field Duplicate	Extra volume of sediment collected at one site, but kept separate for testing
Field Split	Extra volume of sediment collected at one site and composited together for testing
HCl	hydrochloric acid
JAX	Jacksonville Army Corps District
LC_{50}	concentration at which 50% of the organisms die
M	Molar concentration
NaOH	sodium hydroxide
NS	Naval Station
NW	northwest
ODMDS	Ocean Dredged Material Disposal Site
PCB	polychlorinated biphenyls
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedure
SRT	Standard Reference Toxicant
SPP	Suspended Particulate Phase
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

C. Project Deviations Summary

The following list reflects the test deviations from the 2008 SERIM and/or the Original and Retest QAPPs.

Elutriate - Original:

The *Mytilus edulis* normal development was 69% in the test control. The recommended criterion is 70%. Note that this data was still used as it was very close to the recommended criterion.

Solid Phase:

The *Leptocheirus plumulosus* standard reference toxicant (SRT) test exceeded the upper limit of the control chart. There were no remaining Leptos to rerun the SRT and an explanation for this deviation could not be found. However, one is allowed to have one outlier per control chart and this value would be that outlier. Since no problems were seen with the Lepto controls in the 10-day test, it was decided that the organisms were fine and did not adversely affect the results of the Lepto toxicity study.

III. TEST ADMINISTRATION

A. Sponsor

United States Army Corps of Engineers (USACOE)
Jacksonville District
701 San Marco Blvd.
CESAJ-CT
Jacksonville, FL 32207-8175

B. Testing Facilities

Aqua Survey, Inc. (ASI)
469 Point Breeze Road
Flemington, NJ 08822

EnviroSystems, Inc. (ESI)
1 Lafayette Road
Hampton, NH 03842

Columbia Analytical Services (CAS)
1317 153th Avenue
Kelso, WA 98626

MACTEC Engineering and Consulting Inc.
3901 Carmichael Avenue
Jacksonville, FL 32207

ANAMAR Enviromental Consulting
2106 NW 67th Place, Suite 5
Gainsville, FL 32653

C. Dates of Experiment

Date of Study Initiation: January 8, 2010
Date of Study Completion: June 17, 2010

D. Study Participants

Jon Doi, Ph.D.	Executive Vice President and Project Manager
Thomas Dolce	Field Operations Manager
Robert Fristrom	Quality Assurance Officer
Elizabeth Horn	Staff Scientist
G. Stephen Hornberger	Senior Scientist
Matthew Shappell	Field Operations Specialist
Eric Smith	Field Operations Support
Kevin Sondag	Field Operations Support
Michael Telesco	Field Operations Specialist
York Terrell	Staff Scientist
Michelle Thomas	Laboratory Manager

IV. MATERIALS AND METHODS

All sampling and testing was performed according to the Quality Assurance Project Plans on file with the Jacksonville Army Corps District and USEPA Region 4.

A. Sampling - Original

Test sediment and site water samples were collected from the Mayport Naval Station (NS) Basin and reference sediment samples were collected from two sites at the Jacksonville Ocean Dredged Material Disposal Site (ODMDS), Jacksonville, Florida by ASI personnel from January 8 through January 16, 2010.

Aqua Survey, Inc. collected sediment samples to a depth determined by the silt and sand interface and in some cases to a known project depth. The project depth for this project was 50 feet Mean Lower Low Water (MLLW) plus two feet of allowable over depth (PD – 52'). Some of the cores collected were found to be all silt to the project depth of 52 feet and in other cases the silt and sand interface was encountered prior to this depth. In these cases the samples kept were cut at the interface and just the silt was kept for further testing. The sediment core logs identify which

samples were cut prior to project depth, and which cores were silt throughout the entire project length to project depth.

The vessels used for sampling, the R/V Raritan and the R/V Schuylkill, were positioned using a Trimble NT200D Differential Global Positioning System (DGPS). Collection of sediment was performed using a Rossfelder P-3 vibracore with flexible plastic core liners. Each sediment core was inspected and its characteristics were recorded on a sediment core log. DGPS coordinates for sample locations can be found in Table 1. Decontamination between zones was performed using a DI/Alconox scrub on the stainless steel nose cone that was attached to the vibracore barrel, followed by a final rinse with DI water. Between each cell within a zone, the barrel was rinsed with site-water. *In-situ* hydrographic measurements were taken using a HACH kit at the surface, mid-water column and bottom for the following parameters: turbidity, salinity, temperature, pH, conductivity and DO. The meter probe used for these measurements was rinsed with DI water between each cell. All readings can be found in Table 2. Photographs were taken of each core and are provided in Appendix C. Figure 1 shows the site map for these locations.

Site water (ASI ID # 20100033) was collected on January 19, 2010 using a submersible Whale centrifugal pump.

Please note that there was a slight malfunction of the meter at Cell 2D; no measurements for salinity or DO were taken at this location.

Upon arrival at ASI, all samples were logged in and assigned a unique sample number (Table 1). Samples were received in good condition at ASI in Flemington, NJ and stored at 2°C to 4°C. All supporting documentation, including sediment core logs, photographs, chains-of-custody and sample use forms can be found in Volume II.

There were two control sediment samples and one reference sediment used in the biological bioassays. The Sandy Hook Control sediment (ASI ID # 20100019) was obtained from the Gateway National Recreation Area, Atlantic Highlands, NJ, on January 13, 2010. The Tuckerton Control sediment (ASI ID # 20100018) was obtained from Tuckerton Creek at the third bridge, Tuckerton, NJ, on January 12, 2010.

The RS-MP09 Reference sediment (ASI ID # 20100042) was a composite of two sediment samples collected from the Jacksonville ODMDS off the coast of the Mayport NS Basin on January 8, 2010. This reference sediment was collected using a modified dredge grab sampler. Figure 2 provides a site map for these two reference sediment locations.

The Sandy Hook Control was used for the *A. bahia* solid phase bioassay, the *N. virens* bioaccumulation bioassay and the three suspended particulate phase bioassay tests with *A. bahia*, *M. beryllina* and *M. edulis*. The Tuckerton Control was used for the *L. plumulosus* solid phase bioassay and the *M. nasuta* bioaccumulation bioassay. The RS-MP09 reference was used for the *L. plumulosus* and the *A. bahia* solid phase bioassays and the *M. nasuta* and *N. virens* bioaccumulation tests.

Prior to the initiation of testing, all control and reference sediments were sieved using a 1-mm Nytex screen. For the *L. plumulosus* solid phase test, the reference sediment was first sieved through a 1-mm Nytex screen and then press-sieved through a 0.5 mm Nytex screen to be certain no indigenous organisms were present. Test sediment was used unaltered.

Manasquan Water, obtained from Manasquan Inlet, NJ, was used as the overlay water and dilution water for all testing. This water was tested according to ASTM guidelines to ensure purity. The results of the latest water analysis and Sample Receiving Logs are included in Volume II (Appendix I).

B. Sampling - Retest

Test sediment and site water samples were recollected from the Mayport NS Basin, Jacksonville, Florida by ASI personnel from April 7 through April 11, 2010. Sandy Hook control sediment (ASI # 20100316) was collected on March 25, 2010. The same sediment sampling and collection procedures were used as for the original sampling event back in January, 2010. The site water (ASI ID # 20100394) was collected on April 11, 2010 using a submersible pump (manufactured by Proactive Environmental Products, SS Hurricane). A site map of the re-sampled sediment samples and site water is shown in Figure 3. Table 3 provides the DGPS coordinates, and Table 4 shows the *in situ* hydrographic measurements.

Please note that USACOE collected a third site water sample on April 28, 2010 (ASI ID # 20100436) for the repeated *M. edulis* SPP bioassay. The pump used to collected this water sample, a Van Dorn Alpha model # 1120-G45, was authorized for use by Chris McArthur of EPA. Please refer to Section IV.H for a detailed explanation of why this test was repeated.

Please note that the meter used to take the *in situ* measurements, a YSI 6820 sonde with YSI 650 data logger, was unable to obtain turbidity readings starting on the third day of sampling. Problems with turbidity readings were not resolved with recalibration, attempted each day of sampling.

C. Homogenizing and Compositing

Each sediment sample was carefully homogenized using a stainless steel mixer following specific guidelines found on pages 9-11 and Appendix A of the Dredging Manual and according to ASI's standard operating procedure SOP/PRP/008. Samples were mixed until uniform in color and texture. These homogenized core samples were then combined using the same methodology to form the composite sample. Sample identification numbers and the compositing scheme for the composites are provided in Tables 5 and 6.

A 1000 ml subsample from each composite was archived, as required by the Corps, for possible future analysis.

D. Physical Analysis

Sub-samples of all sediments were analyzed by ASI personnel for physical parameters. These sediments include the following: the composite samples, the Sandy Hook, Tuckerton, and the Jacksonville ODMDS Reference sediments. Percent moisture and grain size distribution analyses were performed in accordance with the *Standard Test Method for Particle-Size Analysis of Soils*, Designation: D422-63, Re-approved 2002 [ASTM, 2002]. Sub-samples of the test sediments were sent to MACTEC for sediment settling rate analysis. The elutriates used in the *A. bahia* and *M. beryllina* suspended particulate phase bioassay tests were analyzed for total suspended solids. Atterberg Limits were not required for this project. Thus, USCS classification of sediment is not provided as Atterberg Limits analyses are needed to determine the USCS classification values.

Results of physical analyses are provided as follows: the percent moisture and grain size distribution analyses, Tables 7 through 9; settling rates, Tables 10 and 11; total suspended solids, Tables 12 and 13.

E. Chemical Analysis - Original

Subsamples of the Mayport NS Basin composite samples and the associated Mayport NS Basin site water sample from the original sampling event were shipped to ESI, Hampton, NH for preparation and chemical analysis of the chemical elutriate samples. Note that no chemical analysis was done on the composited sediment samples.

The results of this analysis are provided in Table 21, for your information purposes only. These results are superseded by the analysis of elutriates prepared after the Retest sampling. Please refer to Section VI I.C.2 (i.e., Conclusions and Discussion, Chemical Analysis, Analysis of Retest Elutriate Samples) for a detailed discussion.

F. Solid Phase Testing

Whole sediment toxicity of the composites was assessed through 10-day exposures with the amphipod, *L. plumulosus* and Mysid shrimp *A. bahia* in solid phase bioassays [ASTM, 1999].

After ten days of exposure to the composite, live count data from the solid phase tests for both species were entered into a spreadsheet, sorted and tabulated. Water quality and physical parameters were also monitored. Final live counts are provided in Tables 28 and 29, and water quality parameter tables can be found in Appendix O and Appendix P.

Standard reference toxicant tests were performed for both *A. bahia* and *L. plumulosus*; reference toxicant data were entered into a program based on currently accepted methods for calculating an LC_{50}. The LC_{50} for the Mysid shrimp species fell within the 95% confidence limits of the control chart. Please see Project Deviations summary for a discussion of the Lepto SRT. Control charts can be found in Volume IV (Biological Raw Data) along with SRT raw data.

Leptocheirus plumulosus

The *L. plumulosus* used in testing were 2-4 millimeters in length, and were obtained from Aquatic Research Organisms, Hampton, NH.

The total ammonia in the overlay water of the composite was measured prior to initiation of the 10-day solid phase tests with *L. plumulosus*. The average initial total ammonia in the overlay water ranged from 81 to 101 mg/L, so the ammonia was purged from the samples via aeration and renewals of the overlay water until the total ammonia level was less than 60 mg/L. At this time, the *L. plumulosus* bioassay test was begun.

Americamysis bahia

The *A. bahia* used in testing were 5-day-old juveniles, and were obtained from Aquatic BioSystems, Inc., Fort Collins, CO.

At test initiation, two exposure chambers were set up for each zone as a static test to monitor for ammonia. By the sixth day of testing, all zones had exceeded the 0.6 mg/L threshold established by the USEPA for a pH of 7.9-8.0, and 0.3 mg/L for a pH of 7.5. [Southerland, 1994] Therefore, a static renewal test was conducted.

G. Suspended Particulate Phase Testing - Original

Menidia beryllina, Americamysis bahia and ***Mytilus edulis***

Toxicity of elutriates prepared from the composite was assessed through 48- and 96-hour suspended particulate phase toxicity tests using three test species, the inland silverside, *M. beryllina*, the Mysid shrimp, *A. bahia*, and the blue mussel, *M. edulis*. The biological elutriate samples were prepared from the composite sediment samples from the four zones and the Field Duplicate of Zone 4 and Mayport NS Basin site water.

The *M. beryllina* used for testing were 14 days old and were obtained from Aquatic BioSystems, Inc., Fort Collins, CO.

The *A. bahia* used for testing were 5-day-old juveniles obtained from Aquatic BioSystems, Inc., Fort Collins, CO.

The *M. edulis* used for testing were fertile adults of various ages, and were obtained from Carlsbad Aquafarm, Carlsbad, CA.

After 96 hours of exposure to elutriate concentrates, final live count data were transferred into a spreadsheet, sorted and tabulated for *M. beryllina* and *A. bahia*. Live count results for *M. beryllina* are provided in Table 30; live count results for *A. bahia* in Table 33. Water quality parameter tables are provided in Appendix Q (*M. beryllina*) and Appendix S (*A. bahia*).

After 48 hours of exposure to the elutriate concentration, an EC_{50} for development and an LC_{50} for survival were determined either by using ToxCalc™ software or by visual inspection of the data. The software program was used for calculations when one or more concentrations showed at least 50% effect on the *M. edulis* larvae. Summary tables of results are provided in Appendix U.

Standard reference toxicant tests were performed for *M. beryllina*, *A. bahia*, and *M. edulis* as cited in the work plan. Reference toxicant data were entered into ToxCalc™ and an LC_{50} was calculated. The LC_{50} for each species fell within the 95% confidence limits of their respective control charts. Control charts for each species as well as all supporting bioassay documentation can be found in Volume IV (Biological Raw Data).

H. Suspended Particulate Phase Testing - Retest

Menidia beryllina*, *Americamysis bahia and ***Mytilus edulis***

The biological elutriate samples were prepared from the composite sediment samples from the four zones and field split (Zone 3) and the Mayport NS Basin site water from the second sampling event. Half of the biological elutriate samples were used in the three SPP toxicity tests as is. The other half of the biological elutriate samples were subjected to an ammonia removal procedure (EA Engineering, March 2010) using 10M Sodium Hydroxide (NaOH) to increase the pH above 11, vigorously aerating the elutriate samples while sweeping the air from above the elutriate containers with electric fans. Once the total ammonia concentration was below 5 mg/L for the *M. beryllina* bioassay test and less than 1 mg/L for the *A. bahia* and *M. edulis* bioassay tests, the pH of the elutriate samples was lowered to their original values with 6M Hydrochloric Acid (HCl). A salinity-adjusted Mayport NS Basin site water sample was prepared by adding equivalent amounts of NaOH and HCl such that the salinity of the site water was the same as the elutriate samples. Toxicity of the unadjusted and ammonia-stripped elutriate samples were assessed through 48- and 96-hour suspended particulate phase toxicity tests using three test species, the inland silverside, *M. beryllina*, the Mysid shrimp, *A. bahia*, and the blue mussel, *M. edulis*.

The *M. beryllina* used for testing were 14 days old and were obtained from Aquatic BioSystems, Inc., Fort Collins, CO.

The *A. bahia* used for testing were 5-day-old juveniles obtained from Aquatic BioSystems, Inc., Fort Collins, CO.

The *M. edulis* used for testing were fertile adults of various ages, and were obtained from Carlsbad Aquafarm, Carlsbad, CA.

After 96 hours of exposure to elutriate concentrates, final live count data were transferred into a spreadsheet, sorted and tabulated for *M. beryllina* and *A. bahia.* The live count results for *M. beryllina* are provided in Table 31 and Table 32 (ammonia-stripped samples). The live count results for A. bahia are provided in Table 34 and Table 35 (ammonia-stripped samples).

After 48 hours of exposure to the elutriate concentration, an EC_{50} for development and an LC_{50} for survival were determined by either either calculations within ToxCalc™ or visual inspection of the data.

After calculating the dilution water control sample's survival and normal development, it was determined that this control sample did not pass either

criteria level for survival (>90%) or for development (>70%) and therefore the *M. edulis* test was not a valid test. The *M. edulis* test was repeated. However, after discussion with the Jacksonville Corps and EPA Region 4, it was thought that high salinity of the ammonia-stripped elutriate samples after the pH manipulation to remove the ammonia may have in itself caused higher than acceptable mortality and abnormal development in the control for these samples. To test this theory, two different procedures were tried. Instead of bringing the pH up to greater than 11 with NaOH, the pH in the ammonia-stripped samples was only brought up to a pH of 10. Then, lesser amounts of the HCl was needed to bring the pH back to its original pH, so the salinity was not as high as in the first Retest *M. edulis* test. The second procedure was to dilute the ammonia-stripped elutriate samples with DI water after pH manipulation so that the salinity was reduced to levels acceptable to the test method (30-32 ppt). Both procedures were tried to address the salinity problem.

Standard reference toxicant tests were performed for *M. beryllina, A. bahia*, and *M. edulis* as cited in the QAPP. Reference toxicant data were entered into ToxCalc™ and an LC_{50} was calculated. The LC_{50} for each species fell within the 95% confidence limits of their respective control charts. Control charts for each species as well as all supporting bioassay documentation can be found in Volume IV (Biological Raw Data).

I. Chemical Analysis - Retest

Subsamples of the Mayport NS Basin composite samples and the associated Mayport NS Basin site water sample from the second sampling event were shipped to CAS, Kelso, WA for preparation and chemical analysis of the chemical elutriate samples. These results are provided in Table 21. In addition, CAS analyzed the biological elutriate samples with and without the removal of ammonia. The results of these analyses can be found in Table 23.

J. Bioaccumulation Testing

Macoma nasuta, Nereis virens

Bioaccumulation of metals, pesticides (DDD, DDE, DDT only), PCB congeners, pentachlorophenol, PAHs, and organotins from the composites were assessed using 28-day exposures of the clam, *M. nasuta* and the sand worm, *N. virens*. Bioaccumulation testing was performed in accordance with the work plan.

Results of the five replicates for each treatment (i.e., pre-test tissue, control sediment exposure, reference sediment exposure and test sediment

for Zones 1 through 4 plus Field Duplicate of Zone 4) were averaged. Total PAHs were calculated as the sum of the following: Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Benzo[b]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 1-methylnaphthalene, 2-methylnaphthalene, Naphthalene, Phenathrene, and Pyrene. Total PCBs were calculated as the sum of the following PCB Congeners: 8, 18, 28, 44, 49, 52, 66, 77, 87, 101, 105, 118, 126, 128, 138, 153, 156, 169, 170, 180, 183, 184, 187, 195, 206, and 209. The steady state factors found in Table 1 of Appendix H of the SERIM were applied when appropriate for final calculated concentrations.

Table 24 provides the final calculated mean concentrations for contaminants of interest for the Macoma clam. Table 25 compares the results to FDA action levels. Tables 26 and 27 provide the same results for the Nereis worm.

The *M. nasuta* used in testing were adults of various ages and were obtained from J & G Gunstone, Inc., Port Towsend, WA.

The *N. virens* used for testing were adults of various sizes, and were obtained from Aquatic Research Organisms, Hampton, NH.

After 28-days of exposure to the composite, organisms were depurated overnight in clean Manasquan water. Tissue from each exposure chamber was placed in individual glass jars, weighed and frozen before sending to ESI by overnight courier for chemical analysis. Tissue samples were archived by ESI.

Standard reference toxicant tests were performed for both species as cited in the work plan. Water quality and physical parameters were also monitored as per the work plan. The LC_{50} for the Macoma clam fell within the 95% confidence limits of the control chart. The Nereis worm SRT exceeded its upper control limit. Since a result this high had not occurred in the past it was suspected that a technician error may have occurred during mix out. Another SRT was set up with the same stock solution that was used during the original SRT, and it was confirmed that a mix out error had most likely occurred. The SRT test was deemed an outlier and not used on the control chart. A control chart for each species, as well as all supporting bioassay documentation data can be found in Volume IV (Biological Raw Data).

K. Statistical Analysis of Results

The results of all biological testing were statistically analyzed using ToxCalc™, Version 5.0.23F. All statistical analyses follow guidance provided by US EPA [Green Book, 1991].

For Solid Phase Testing, hypothesis tests to determine statistically significant adverse effects of each sample when compare to reference were conducted. Results were analyzed for normality (Shapiro-Wilk's) and homogeneity (Bartlett's) of variance. If the data did not pass these tests, it was transformed using arcsin square root transformation and the transformed data was then used. If the transformed data did not pass these normality and homogeneity tests, the untransformed data was analyzed using Steel's Many One Rank test. Hypothesis testing was 1-tailed, ($\alpha = 5$) using the Dunnett's test.

For Suspended Particulate Phase Testing, lethal concentration (LC_{50}) values for survival of all three species (i.e., *A. bahia*, *M. beryllina* and *M. edulis*) and effect concentration (EC_{50}) for *M. edulis* were calculated using either the Probit method, Spearman-Karber method, or the Graphical method, when applicable. If survival or development was greater than 50% in all concentrations, the LC_{50}/EC_{50} values were determined to be >100%.

For Bioaccumulation tissue results, hypothesis tests to determine statistically significant bioaccumulation of each contaminant of interest in organisms exposed to the test sediments as compared to the bioaccumulation of the specific contaminant in organisms exposed to reference sediment were conducted. Results were analyzed for normality (Shapiro-Wilk's) and homogeneity of variance (F-test). If the data did not pass these tests, it was transformed using arcsin square root transformation and the transformed data was then used. The two-sample t-test was used to determine significance.

All statistical analyses can be found in Appendix Y.

V. RESULTS

A. Field Data and *In Situ* Measurements

Field data and *in situ* water quality measurements for both sampling events can be found in Tables 1 through 4. Tables 1 and 2 summarize field data sampling technique, water depth, site location, and tide for each sample. It also summarizes date and time the samples were collected at each location. Tables 2 and 4 summarize *in situ* measurements: position of sampling (surface, mid-water, or bottom) as well as turbidity (NTU),

salinity (ppt), temperature (°C), pH (SU), conductivity (ms/cm), and dissolved oxygen (mg/L).

For the first sampling event (January), the weather was breezy and cold. Project depth was met for all sample locations (refer to Appendix A for further detail). For sample EMP09-3E collection time was accidentally not recorded, but was figured out based off of a tide of 1.1ft. and the digital photo of the core. The depth of site water collection was accidentally not recorded, but was collected within 1 meter from the bottom of the basin. For sample location EMP09-2D there was a malfunction of the water quality meter, therefore readings for salinity and dissolved oxygen could not be taken.

For the second sampling event (April), the weather was partly sunny, warm, and breezy. Project depth was met for all sample locations (refer to Appendix B for further detail). For the site water collection the water depth was 44.0 feet and was collected at 41.0-42.0 ft. For sample locations EMP09-1A-E, EMP09-3A,B,D and E, and EMP09-4A-E there was a malfunction of the water quality meter therefore readings for turbidity could not be taken. Also at location EMP09-4A the current was very strong when taking the bottom *in situ* readings. It should also be noted that for locations EMP09-2A-B and EMP09-4A-C, pH measurements showed up to be lower than expected (7.0 or above); this may also be due to meter malfunction, as there were pH calibration issues noted in the field log.

B. Physical Testing

Physical testing data for both sampling events can be found on Tables 7 through 11, as well as in Appendices J-N.

Samples collected for the first sampling event (January) were mainly silty in consistency and were dark grayish black in color. Zone EMP09-2 appeared to be more of a dark olive gray in color and had some fine sand present. Zone EMP09-4 had some clay and shell fragments present. The reference zone was fine sand and grayish in color. Table 7 (Table 8 for the reference site) and Appendix J contain the data for particle size (percent gravel, sand, and silt/clay) and percent moisture of each location composite. Table 10 and Appendix M contain the data for the settling rates of each location composite.

Samples collected for the second sampling event (April) were mainly silty in consistency and were dark grayish black in color. Zones EMP09-3 and EMP09-4 each had some fine sand present. Table 9 and Appendix K contain the data for particle size (percent gravel, sand, and silt/clay) and

percent moisture of each location composite. Table 11 and Appendix N contain the data for the settling rates of each location composite.

C. Biological Testing

Test results of all the biological tests are summarized in the tables at the end of this volume. Raw data for physical characteristics, biological effects and water quality parameters, are presented in Volume IV.

1. Solid Phase Testing

Leptocheirus plumulosus

After 10 days, survival of *L. plumulosus* organisms exposed to the composites was as follows:

L. plumulosus Bioassay	
Sediment Name	**% Survival**
Control	100%
Reference	96%
E-MP09-1	90%
E-MP09-2	87% *
E-MP09-3	87% *
E-MP09-4	95%
E-MP09-5 (Field Duplicate of Zone 4)	91%

*indicates statistically significant as compared to the reference

Comparing the test treatments to the reference, Shapiro Wilk's Test indicates normal distribution and Bartlett's test indicates equal variance of data. Dunnett's test indicates that results for Zone 2 and Zone 3 are statistically significant. Statistical analysis report can be found in Appendix Y.

In accordance with the 1991 Federal Guidance [USEPA, 1991], samples are considered toxic if survival of animals exposed to test sediment are at least 20% less than the survival observed in the

reference sediment and this difference is statistically significant ($p = 0.05$) after a ten-day test period.

These results indicate that the composites are not acutely toxic to *L. plumulosus.*

Americamysis bahia

At test initiation, two exposure chambers were set up for each zone as a static test to monitor for ammonia. By the sixth day of testing, all zones had exceeded the 0.6 mg/L threshold established by the USEPA for a pH of 7.9-8.0, and 0.3 mg/L for a pH of 7.5. [Southerland, 1994] Therefore, a static renewal test was conducted.

Static Renewal Bioassay

After the 10-day static renewal bioassay, the survival of organisms exposed to the sediment did not show a statistically significant reduction in survival when compared to organisms in the reference sediment.

A. bahia **Bioassay**	
Sediment Name	**% Survival**
Control	96%
Reference	88%
E-MP09-1	77%
E-MP09-2	84%
E-MP09-3	80%
E-MP09-4	75%
E-MP09-5 (Field Duplicate of Zone 4)	86%

Comparing the test treatments to the reference, Shapiro Wilk's Test indicates normal distribution and Bartlett's test indicates equal variance of data. Dunnett's test indicates no results are statistically significant. Statistical analysis report can be found in Appendix Y.

In accordance with the 1991 Federal Guidance [USEPA, 1991], samples are considered toxic, if survival of animals exposed to test sediment are at least 10% less than the survival observed in the reference sediment and this difference is statistically significant ($p = 0.05$) after a ten-day test period.

These results indicate that the composites are not acutely toxic to *A. bahia.*

2. Suspended Particulate Phase Testing, Original Sampling

Menidia beryllina

After 96 hours, *M. beryllina* exposed to the suspended particulate phase elutriate resulted in the following results:

M. beryllina Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	E-MP09-5 Field Dup of Zone 4
Control	100%				
SH Control	100%				
10%	100%	98%	100%	100%	100%
50%	6%	64%	52%	34%	30%
100%	0% *	0% *	0% *	0% *	0% *
LC_{50}	24.0%	46.7%	40.7%	33.1%	31.6%

* indicates statistically significant as compared to the control

Comparing the 100% elutriate test treatments to the control for survival, all zones have been deemed (100% mortality) statistically significant as compared to the control. Lower concentration exposures (i.e., 10%, 50%) were not tested for statistical significance. Statistical analysis reports (i.e., LC_{50} calculations) can be found in Appendix Y.

Americamysis bahia

After 96 hours, *A. bahia* exposed to the suspended particulate phase elutriate resulted in the following results:

A. bahia Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	E-MP09-5 Field Dup of Zone 4
Control	98%				
SH Control	100%				
10%	100%	100%	100%	100%	98%
50%	100%	100%	92%	96%	100%
100%	0% *	0% *	0% *	0% *	0% *
LC_{50}	70.7%	70.7%	65.2%	68.3%	70.7%

* indicates statistically significant as compared to the control

Comparing the 100% elutriate test treatments to the control for survival, all zones have been deemed (100% mortality) statistically significant as compared to the control. Statistical analysis reports (i.e., LC_{50} calculations) can be found in Appendix Y.

Mytilus edulis

M. edulis Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	E-MP09-5 Field Dup of Zone 4
Control	92%				
SH Control	93%				
10%	87%	89%	80%	86%	86%
50%	79%	70%	59%	70%	58%
100%	58% *	61% *	55% *	62% *	51% *
LC_{50}	>100%	>100%	>100%	>100%	>100%

* indicates results are statistically significant as compared to the control

M. edulis Development					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	E-MP09-5 Field Dup of Zone 4
Control	69%				
SH Control	68%				
10%	59%	68%	61%	68%	68%
50%	0%	0%	0%	0%	0%
100%	0%	0%	0%	0%	0%
EC_{50}	20.6%	22.4%	22.4%	21.9%	22.4%

Comparing the 100% elutriate test treatments to the control for survival, Shapiro-Wilk's Test indicates normal distribution and Bartlett's Test indicates equal variance. Dunnett's Test indicates that all zones are statistically significant. Statistical analysis reports (i.e., survival of 100% elutriate to the control and LC_{50}/EC_{50} calculations) can be found in Appendix Y.

Control survival was greater than 90% for *M. beryllina, A. bahia* and *M. edulis.* The number of *M. edulis* control embryos that resulted in live larvae with completely developed shells at the end of the test was very close to 70% (actual control normal development was 69%). Therefore, the SPP tests for all three organisms should be acceptable for the control criteria.

3. Suspended Particulate Phase Testing, Retest Sampling

Menidia beryllina

After 96 hours, *M. beryllina* exposed to the suspended particulate phase elutriate resulted in the following results:

M. beryllina Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	Field Split of Zone 3
Control	100% (normal) / 100% (ammonia-stripped)				
SH Control	96%				
MP Site Water	98%				
MP Site Water, salinity adjusted	96%				
10%	98%	100%	100%	94%	98%
50%	0%	20%	8%	0%	28%
100%	0% *	0% *	0% *	0% *	0% *
LC_{50}	22.0%	28.2%	24.5%	22.0%	30.1%
100% NH_3 stripped	94%	96%	94%	100%	96%
LC_{50} (single point)	>100%	>100%	>100%	>100%	>100%

* indicates results are statistically significant as compared to the control

Comparing the 100% elutriate test treatments to the control for survival, all zones have been deemed (100% mortality) statistically significant as compared to the control. Statistical analysis reports, (i.e., LC_{50} calculations), can be found in Appendix Y.

Comparing the ammonia-stripped test treatments to the control for survival, Shapiro Wilk's Test indicates non-normal distribution and equality of variance cannot be determined. Steel's Many-One Rank Test indicates no results are statistically significant. Statistical analysis reports (i.e., survival of 100% elutriate compared to control and LC_{50} calculations) can be found in Appendix Y.

Americamysis bahia

After 96 hours, *A. bahia* exposed to the suspended particulate phase elutriate resulted in the following results:

A. bahia Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	Field Split of Zone 3
Control	98% (normal) / 92% (ammonia-stripped)				
SH Control	100%				
MP Site Water	86%				
MP Site Water, salinity adjusted	96%				
10%	100%	98%	98%	90%	100%
50%	86%	96%	94%	100%	94%
100%	2% *	8% *	2% *	18% *	8% *
LC_{50}	63.9%	75.5%	69.9%	75.7%	72.7%
100% NH_3 stripped	66% *	84%	72%	56% *	66% *
LC_{50} (single point)	>100%	>100%	>100%	>100%	>100%

* indicates results are statistically significant as compared to the control

Comparing the 100% elutriate test treatments to the control for survival, all zones have been deemed (>80% mortality) statistically significant as compared to the control. Comparing the ammonia-stripped test treatments to the control for survival, Shapiro Wilk's Test indicates normal distribution and Bartlett's test indicates equal variance of data. Dunnett's test indicates that results for Zone 1, Zone 4 and the Field Split of Zone 3 are statistically significant. Statistical analysis reports (i.e., survival of 100% elutriate compared to control and LC_{50} calculations) can be found in Appendix Y.

Mytilus edulis – First Retest

After 48 hours, *M. edulis* larvae exposed to the suspended particulate phase elutriate resulted in the following:

M. edulis Survival and Normal Development	
Control Survival	84.9%
Control Development	62.3%

Control survival and development criteria of >90% and >70%, respectively, were not met. The test was deemed unacceptable and was repeated.

Mytilus edulis – Second Retest

As stated in the Materials and Methods section, the first Retest *M. edulis* study did not pass the criteria for either survival or development. For that reason, the *M. edulis* test was repeated. It was also stated in the Materials and Methods section that two additional procedures were added to the unaltered and ammonia-stripped elutriate samples. These included not being so aggressive with the pH manipulation (only bringing the pH up to greater than 10 instead of greater than 11 before beginning the ammonia purging procedure) to reduce the amount of salinity added to the elutriate samples due to the added base and acid and diluting the ammonia-stripped elutriate samples with DI water such that the salinity of the samples was reduced to acceptable values according to the testing method.

M. edulis Survival					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	Field Split of Zone 3
Control	96.6%				
SH Control	97.1%				
MP Site Water	92.5%				
MP Site Water, salinity adjusted	96.0%				
10%	76.8%	86.5%	91.7%	98.8%	87.0%
50%	59.2%	72.9%	54.6%	59.6%	58.3%
100%	47.9% *	44.3% *	32.8% *	41.9% *	27.8% *
LC_{50}	>100%	91%	62%	78%	60%
100% NH_3 stripped	93.5%	95.8%	95.2%	99.0%	97.3%
LC_{50} (single point)	>100%	>100%	>100%	>100%	>100%

* indicates results are statistically significant as compared to the control

M. edulis Development					
Concentration	E-MP09-1	E-MP09-2	E-MP09-3	E-MP09-4	Field Split of Zone 3
Control	71.3%				
SH Control	N/A				
MP Site Water	N/A				
MP Site Water, salinity adjusted	N/A				
10%	60.1%	67.9%	65.2%	62.1%	70.4%
50%	0%	0%	0%	0%	0%
100%	0%	0%	0%	0%	0%
EC_{50}	22.4%	22.4%	21.6%	21.9%	21.7%
100% NH_3 stripped	72.3%	73.2%	72.8%	72.9%	74.3%
EC_{50} (single point)	>100%	>100%	>100%	>100%	>100%

Comparing the 100% elutriate test treatments to the control for survival, Shapiro-Wilk's Test indicates normal distribution and Bartlett's Test indicates equal variance. Dunnett's Test indicates that all zones are statistically significant. Comparing the ammonia-stripped test treatments to the control for survival, Shapiro Wilk's Test indicates normal distribution and Bartlett's test indicates equal variance of data. Dunnett's test indicates that no treatments are statistically significant.

Statistical analysis reports (i.e., survival of 100% elutriate to the control and LC_{50}/EC_{50} calculations) can be found in Appendix Y.

Control survival was greater than 90% for *M. beryllina, A. bahia* and *M. edulis.* The number of *M. edulis* control embryos that resulted in live larvae with completely developed shells at the end of the test was greater than 70%. Therefore, the SPP tests for all three organisms passed the control criteria.

4. Bioaccumulation Testing

Macoma nasuta

After 28 days, *M. nasuta* exposed to the composite resulted in the following survival:

***M. nasuta* Bioaccumulation**	
Sediment Name	**% Survival**
Control	95%
Reference	97%
E-MP09-1	91%
E-MP09-2	96%
E-MP09-3	87%
E-MP09-4	90%
E-MP09-5 (Field Duplicate of Zone 4)	92%

Nereis virens

After 28 days, *N. virens* exposed to the composite resulted in the following survival:

***N. virens* Bioaccumulation**	
Sediment Name	**% Survival**
Control	97%
Reference	99%
E-MP09-1	94%
E-MP09-2	100%
E-MP09-3	100%
E-MP09-4	97%
E-MP09-5 (Field Duplicate of Zone 4)	97%

Water quality parameter summary tables are provided in Appendix W (Macoma clam) and Appendix X (Nereis worm). Summary

tables comparing the mean concentration of bioaccumulation of contaminants of concern in the test treatment as compared to the reference sediment are provided in Table 24 (Macoma clam) and Table 26 (Nereis worm). These tables include both wet weight and dry weight results. Comparison of final calculated concentrations to FDA action levels are provided in Tables 25 and 27, respectively. Complete tables for calculating the means can be found in the are provided in Appendix W (Macoma clam) and Appendix X (Nereis worm). Also in the same Appendices are calculations for adjusting for dry weight (i.e., wet weight value divided by % solids).

VI. QUALITY ASSURANCE AND QUALITY CONTROL

Chemical data quality was monitored and assured by Envirosystems, Inc. (ESI), Columbia Analytical Services (CAS) and Aqua Survey, Inc. (ASI). Please refer to Table 18 for a list of all methods used with their achieved detection limits. All SOPs (Analytical, Physical & Biological) have been followed unless otherwise noted and have been included with the QAPP, which was submitted to the USACOE in January 2010 and is also on file with EPA Region 4.

ASI monitored field activities as well as all sample preparation and testing for physical and biological testing.

A. Chemical Laboratories QA/QC

All analytical data presented appears to be acceptable. Please refer to Volume V (Site water and Elutriate) and Volume VII (Tissue) for ESI Case Narrative along with all associated analytical results. Please refer to Volume VI for CAS Case Narrative and all associated results. There were a number of exceptions noted, none of which appear to be of significant concern. Please refer to Appendix Z for data review and validation check list and summary.

B. Physical and Biological QA/QC

ASI's Quality Assurance Officer monitored the physical and biological analyses on a daily basis. Please refer to Appendix Z for data review and validation check list and summary as well as Toxicity Test Experimental Design and Water Quality Forms.

VII. CONCLUSIONS AND DISCUSSION

A discussion of each different part of the project is shown below.

A. Sampling

The original sediment sampling in the Mayport NS Basin occurred in January 2010. Four zones within the Mayport NS Basin were sampled. Sediment samples from five cells within each zone were collected and eventually composited into the four zone composite samples. Additional sediment volume was collected in Zone 4 for use as a Field Duplicate sample for testing purposes. This Field Duplicate sample was treated as a separate sample at the time of collection and called the Zone 5 sample. Site water from the Mayport NS Basin was collected. In addition, reference sediment from two locations in the Jacksonville ODMDS was collected.

Sediment samples from all four zones within the Mayport NS Basin were resampled in April 2010. Additional sediment volume was collected in Zone 3 for use as a Field Split sample for testing purposes. This Field Split sample was composited together at the time of collection and only separated in the laboratory for testing. Mayport NS Basin site water was also recollected at the same time.

B. Biological Testing

1. Solid Phase Testing

Leptocheirus plumulosus

The results indicate that the zone composites are not acutely toxic to *L. plumulosus.*

Americamysis bahia

At test initiation, two exposure chambers were set up for each zone as a static test to monitor for ammonia. By the sixth day of testing, all zones had exceeded the 0.6 mg/L threshold established by the USEPA for a pH of 7.9-8.0, and 0.3 mg/L for a pH of 7.5. [Southerland, 1994] Therefore, a static renewal test was conducted.

These results indicate that the composites are not acutely toxic to *A. bahia.*

2. Suspended Particulate Phase Testing, Original Sampling

Menidia beryllina

The LC_{50} values were as low as 24.0% for Zone 1 to as high as 46.7% for Zone 2.

Americamysis bahia

The LC_{50} values were quite consistent. They were as low as 65.2% for Zone 3 to as high as 70.7% for Zones 1, 2 and the Field Duplicate of Zone 4.

Mytilus edulis

The LC_{50} values for survival were all greater than 100%. The EC_{50} values for development were quite consistent, ranging from 20.6% to 22.4%.

3. Suspended Particulate Phase Testing, Retest Sampling

Menidia beryllina

The LC_{50} values for the unaltered elutriate samples were similar to the Original test results. The values were as low as 22.0% for Zones 1 and the Field Split of Zone 3 to as high as 30.1% for Zone 4.

The LC_{50} values for the ammonia-stripped elutriate samples were greater than 100% for all the zone samples (100% concentration only). Note that the salinity-adjusted Mayport NS Basin site water sample (to be at the same salinity as the zone samples), even at a salinity of 41 ppt, showed survival values no different from the dilution water control.

Americamysis bahia

The LC_{50} values for the unaltered elutriate samples were quite similar to the Original test results. The values were as low as 63.9% for Zone 1 to as high as 75.7% for the Field Split of Zone 3.

The LC_{50} values for the ammonia-stripped elutriate samples were greater than 100% for all the zone samples (only 100% concentration was tested). Note that the salinity-adjusted Mayport NS Basin site water sample (to be at the same salinity as the zone samples), even at a salinity of 45 ppt, showed survival values no different from the dilution water control.

Mytilus edulis – First Retest

This *M. edulis* test failed both the survival and development criteria for an acceptable test, so its results were not used and the test was repeated.

Mytilus edulis – Second Retest

Two additional procedures were added to the ammonia-stripped elutriate samples. These included not being so aggressive with the pH manipulation (only bringing the pH up to greater than 10 instead of greater than 11 before beginning the ammonia purging procedure) to reduce the amount of salinity added to the elutriate samples due to the added base and acid and diluting the ammonia-stripped elutriate samples with DI water such that the salinity of the samples was reduced to acceptable values according to the testing method.

The LC_{50} values for survival for the unaltered elutriate samples were all greater than 100%. The EC_{50} values for development were remarkably similar to the original test. The original elutriate samples had an EC_{50} value range of 20.6 to 22.4%. The second retest elutriate samples had an EC_{50} value range of 21.6 to 22.4%.

The LC_{50} values for the ammonia-stripped elutriate samples were greater than 100% for all the zone samples (only 100% concentration was tested). Note that the salinity-adjusted Mayport NS Basin site water sample (to be at the same salinity as the zone samples), even at a salinity of 37 ppt, showed survival and development values no different from the dilution water control.

Control survival was greater than 90% for *M. beryllina, A. bahia.*and *M. edulis.* The number of *M. edulis* control embryos that resulted in live larvae with completely developed shells at the end of the test was greater than 70%. Therefore, the SPP tests for all three organisms passed the control criteria.

4. Bioaccumulation Testing

Macoma nasuta

The *M. nasuta* bioaccumulation test showed survival of 87% or higher for all the zone sediment composites. The Control and Reference sediment samples had survivals of 95 and 97%, respectively.

Nereis virens

The *N. virens* bioaccumulation test showed survival of 94% or higher for all the zone sediment composites. The Control and Reference sediment samples had survivals of 97 and 99%, respectively.